THE Portland CEMENT INDUSTRY in the United States

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HISTORY

OF THE

Portland Cement Industry

IN THE

UNITED STATES.

AMERICAN CEMENT COMPANY, PUBLISHERS,

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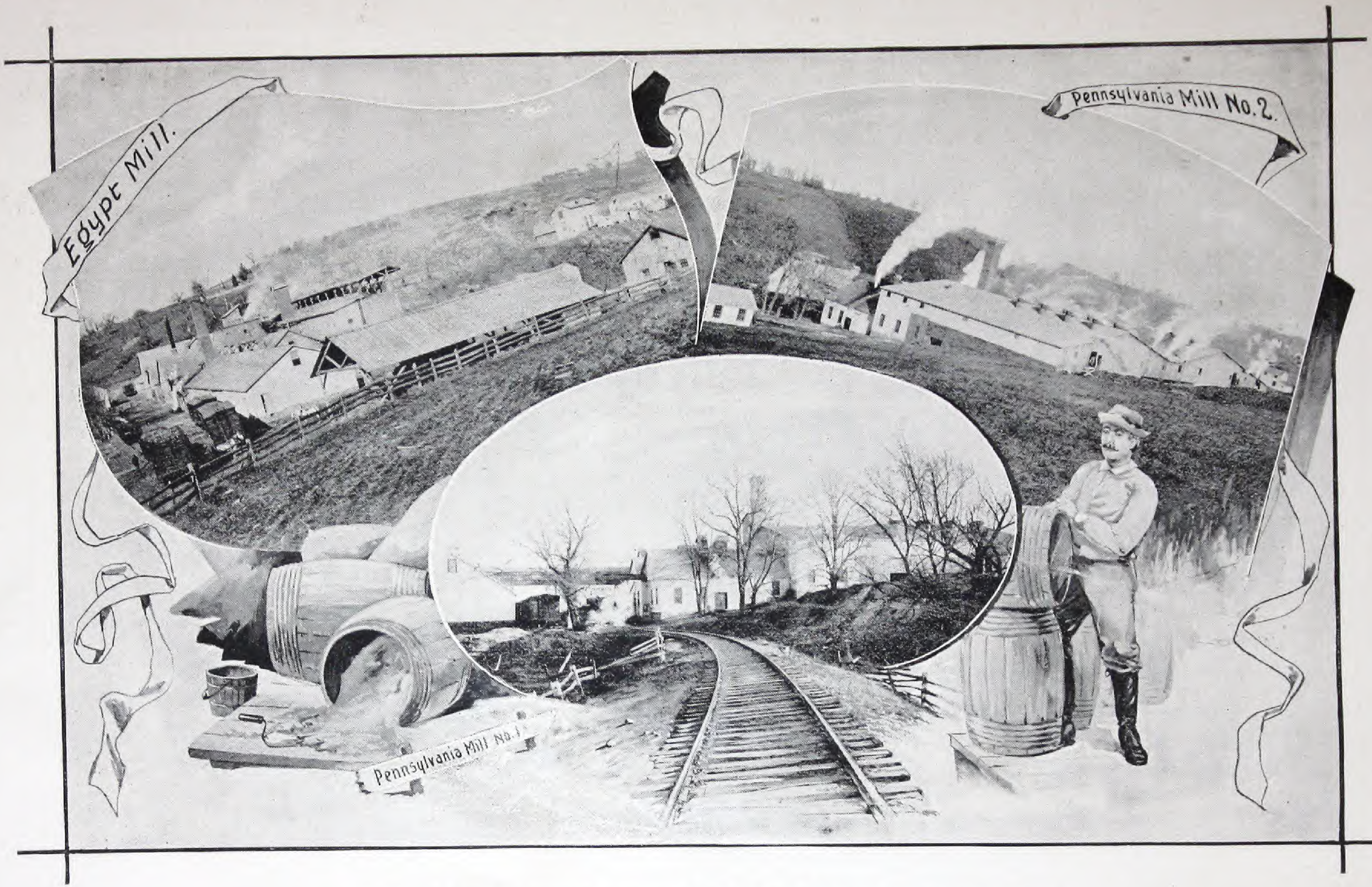
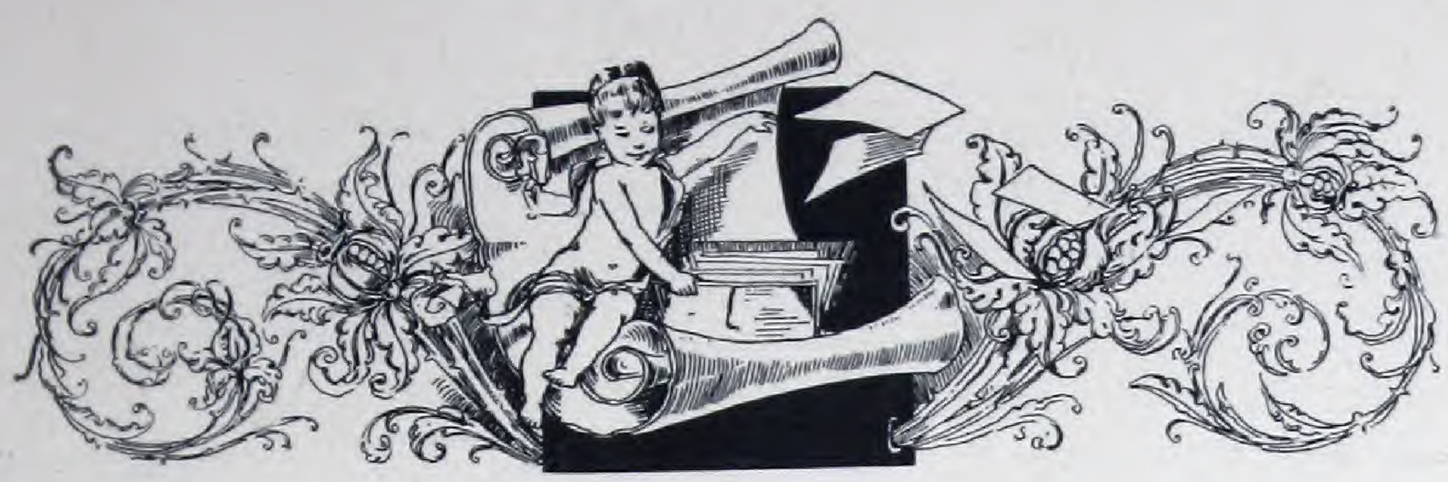
PHILADELPHIA, U. S. A.



Works of American Cement Company, Egypt, Lehigh County, Penna., 1885-1890.

Over 15,000 barrels "Giant" and "Improved Union" Cements used in Kilns, Mills and Engine Foundations.



Facts About American Portland Cement.

TO the average American of twenty-five years ago, the idea that the United States could produce steel rails was almost beyond his conception ; while the thought that the manufacture of silk in this country could acquire a growth almost equal to that of France, was one that the American of twenty years ago could hardly grasp. So, too, within more recent periods, it has been a difficult thing for many of us to imagine the growth of industries in this country that seem almost to belong to Europe. This has been the case, not only with the industries above mentioned, but with the manufacture of analine dyes, soda ash, and latterly, with the manufacture of Portland Cement. This latter industry has, by historical precedent, almost seemed to be essentially a European one. Whenever cement is spoken of, the mind at once reverts to Roman Cement, because all the large works of the Romans were constructed with a mixture of lime and puzzolana, which gave them their lasting character, and gave the cement of which they were composed its well-known reputation. Naturally, therefore, in later years, when the Roman Cement, which was first imitated in England, by a natural product, made by grinding the nodules of the septaria, began to give place to the artificially produced Portland Cement, after this latter's invention in England, in 1824, this country looked to Europe for its supply of this newly manufactured article of commerce.

This was the natural course of facts, especially as Portland Cement, when it first came in use, was an article of great rarity and value, and one which was used with great caution, and whose production was surrounded with mystery ; but, as time went on, the manufacture of Portland Cement spread from England to Belgium, where a daughter of Aspdin, the original inventor, had located, and then to Germany, and then all over Europe, where it has now become one of the leading industries, running up into millions of barrels per annum.

As already stated, the first people known to history to use cement in any large way were the Romans, who produced, by a mixture of fat lime and puzzolana, (a volcanic dust), a resultant mortar which had great hydraulic powers, and which was used by them, and is, in fact, used to-day by many of the nations

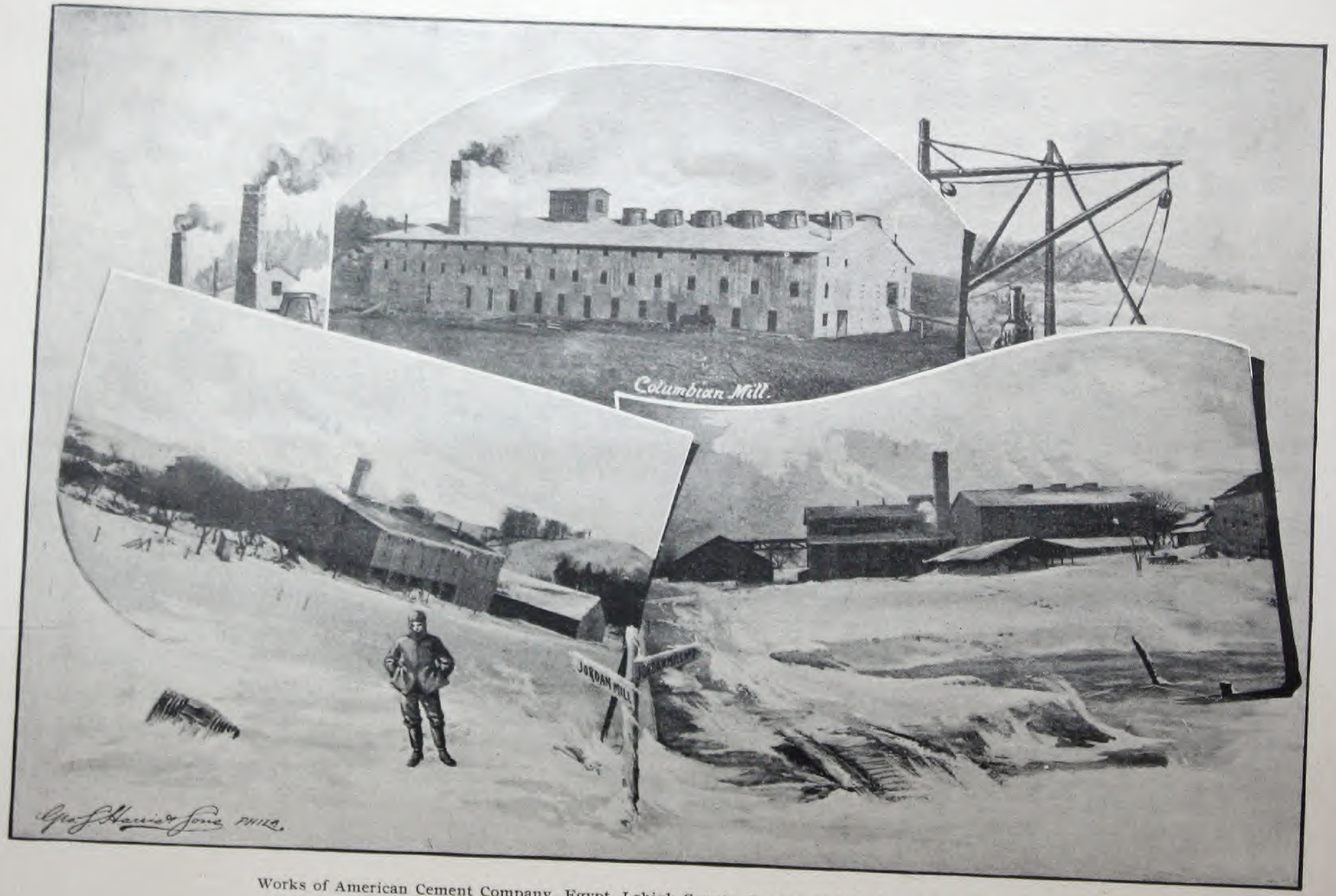
bordering the Mediterranean for large public works and hydraulic constructions. For many centuries after the Romans, whose methods are so well described by Vitruvius and other classic writers, the masonry in Europe was generally done with a mortar composed of a mixture of fat lime and sand, the material being mixed together in pits, where it was left to slack for sometimes two and three years before use. The object of this long slacking was to thoroughly incorporate the lime and the sand, and to form, as near as possible, silicates of lime which would add strength to the mortar. This mode of mortar making was at times seriously disputed, and in France an ingenious writer and enthusiast humbly addressed a paper to his Majesty, Louis XIV., King of France, etc., etc., in old French black letter print, asserting that the true way to use lime, to make good mortar, was to use it hot and not slacked. From these authorities, two schools of practice grew, neither having mastered the fundamental principle of the hydraulic mortar of the Romans; and it was not until 1759, when John Smeaton, a civil engineer engaged to re-construct the celebrated Eddystone Lighthouse, which had succumbed twice to the elements, once to water and once to fire, that the true principle of hydraulic mortars was arrived at; and, as is the usual way, grew out of the necessity of securing a mortar strong enough to withstand the influence of sea water, and the mechanical action of the violent storms to which the Lighthouse was exposed. The problem presented was successfully solved by Smeaton, who after testing the various limestones of Engtand, established the principle that a limestone, yielding, when dissolved in hydrochloric acid, a residue of from fifteen to twenty-five per cent. of solids, would, when mixed with sand, harden under water. This residue, mostly silica and alumina, practically represented the chemical constituents of the Roman puzzolana. As a result of Smeaton's discovery, search was made all over England for hydraulic limestone, and among others found were liver-colored lumps of stone, or nodules of the septaria discovered by Parker in 1796. From these, the first natural cement known to commerce was produced; and, as the only cement known, was Roman Cement, the name of Roman Cement was given to this material, which, in point of fact, resembles closely the Rosendale, Lehigh and other natural common cements in this country. This discovery of a natural cement involved a very simple process of manufacture, and is the process still adopted in the production of the many millions of barrels of light-burnt hydraulic cement made in this country. It consists in simply quarrying argillaceous limestones or dolomites, containing certain percentages of lime, magnesia, silica and alumina; calcining the broken rocks in open kilns, with coal at a light heat, and drawing the calcined product continuously from the kilns, and grinding it between millstones. The resultant powder is barreled or put in sacks, and is the ordinary light-burnt natural hydraulic cement of commerce.

Smeaton's experiments was followed in England by those of Sir C. W. Paisley, another distinguished English engineer. At the same time, Vicat, a celebrated

French engineer and chemist, was conducting experiments in the same direction, though dealing with more elements than the simple sand and limestones of Smeaton. As a result of his work, he arrived at artificial mixtures of clays and fat limes, which, after calcination, produced hydraulic cement. The first practical man, however, to make Portland Cement was Joseph Aspdin, a bricklayer, of Leeds, England, who took out a patent in 1824, and who, in a small works that he erected with great difficulty, and at great personal deprivation, produced the first commercial Portland Cement, by combining the English chalks with clay from the river beds, drying the mixed paste and calcining at high heat the material thus produced. This calcination was done in closed kilns, and the product was a clinker, which, when ground, formed a cement of great strength and hydraulic character, and to which the name of Portland Cement was given, because the stone it produced when used in concrete, resembled, closely, in color the well-known "Portland" building stone of England.

This Cement, as will be seen from the above description, differs from the natural light-burnt hydraulic cement, in the fact that it is an artificial product, wherein the proportions of lime, silica and alumina are combined in uniform proportions, and wherein the material that is calcined in a kiln is a *new rock* or stone, artificially produced by the mechanical mixing of the clay and lime, or of the natural rocks composing it, in finely divided particles with water, so that each of the fine particles of alumina and silica and lime is in close mechanical combination with the other particles, and the whole *new rock* that is placed in the kiln in the shape of bricks, eggs or balls, for the purpose of calcination, is mechanically fitted to be best acted upon by the high heat of the kiln, in order that the chemical action necessary for the production of the highest grade cement can take place under the most favorable circumstances.

In the natural cement, the rock is taken in the condition that nature has given it, and the calcination is at a low temperature; and while in the Portland Cement, burnt at high heat, all the elements are or should be active; in natural cement a large percentage of the material is inert and has no value of a cementing character. Given, therefore, the facts governing the production of cement, it can readily be perceived, that as necessity is the mother of invention, the first efforts towards the production of cement in this country were along the first water ways that were opened, and wherein hydraulic mortars of moderate strength were required for constructing purposes. In order to build the locks, walls, bridges, etc., over the canals that were built in this country in the "forties," cement rocks were found and cement works were built along the Hudson, near Roundout, on the line of the Delaware and Hudson Canal: along the Lehigh at Siegfried's bridge, where the old Lehigh Canal was built; on the Potomac, near Hancock and Cumberland, Md., on the line of the Chesapeake and Ohio Canal; and at Louisville, Ky., where the canal around the falls of the Ohio was constructed. These natural hydraulic cements,



Works of American Cement Company, Egypt, Lehigh County, Penna., and Jordan, New York, 1891-92.

Over 5000 barrels "Giant" Cement used for Kilns, Mills and Engine Foundations.

produced by burning argillaceous limestone, at low heats, were all of excellent character, and, in many cases, far superior to the old Roman cement of antiquity, as well as the Roman cement that had been imported in small quantities from England; and the places of their manufacture gave rise to methods in the business, solely dependent upon water transportation, and caused the adoption in the American market of barrels, a package adapted to ships rather than railway cars, as the best fitted package for the shipment of cement. Of late years, however, since the increase of railroads, bags are largely superseding barrels. From 1840 until 1875, the growth of the American cement industry, as evidenced in the manufacture of light-burnt natural cements, was enormous. Works sprang up all over the country and a closely competitive business of great proportions has been the result.

While these developments in the manufacture of a cheaper grade of cement were going on in this country, the development of the Portland Cement industry was going on in Europe; the first important work to give it standing being its use in 1859 in the construction of the Thames embankment of the London Drainage System, by John Grant, the celebrated English engineer. The first specifications were very simple and very moderate tensile strength was required, and not much care was taken as to grinding, or as to any of the other elements that are so carefully watched to-day. The manufacturers were the authority on cement, and whatever their opinion was, was considered the fact as governing the product. By 1860, Portland Cement was pretty well established all over Europe, and almost all large public work was constructed with it. Cement works were started in Belgium, France, Germany, and Austria shortly after the successful manufacture of Portland Cement in England, and the competition of manufacturers gave rise to a very serious character of tests. From 1860 until 1870, and, in fact, down to the present time, official stations for testing cement were established in various points in Germany, and at the principal large cities in Austria and France, and elsewhere on the Continent under Government auspices; while in England, several important engineers established testing laboratories of their own, under individual management.

Shortly after the war in the United States, Portland Cement first began to appear in this country, being imported in small quantities, and gradually working its way into more general use. From 1865 until 1876, the entire amount of Portland Cement in this country came from abroad, and owing to the secrecy involved in the business and the fact that it was an article, the properties of which were not thoroughly understood, and were, therefore, more or less invested with an air of mystery, it was thought, for many years, that no Portland Cement could be made in this country, because we lacked the chalk and clay out of which it had been so successfully made abroad.

With the advance in engineering that the last twenty years has seen, and the immense increase in the size and character of buildings, of tunnels, of bridges, of

Central Stores—Foot of 27th Street, North. See page 68.

Floor Area, 25 Acres. 16½ millions of Bricks. 6000 yards Concrete.
"Giant" and "Globe" Portland and "Improved Union" used, 40,000 bbls.
Architect, T. P. Mallory. Contractors, Cofrode & Saylor, Incorporated 1891.

dams, of reservoirs, and, in fact, of all public work, there grew a steady and positive demand for a cement of a better character than the ordinary light-burnt cement of the American market. This gave rise to large and increased imports of Portland Cement and to the exercise of the American talent for endeavoring to supply an existing necessity.

In Lehigh County, Penna., David O. Saylor, a farmer's boy had, after many adversities, become engaged, in a small way, in the manufacture of ordinary common cement. His attention had naturally been called to the increased importations of foreign Portland Cement, and he made up his mind that he would manufacture an equally good product in this country. At that time, even in Europe, the business was surrounded with considerable vigilance and mystery, and but little information could be obtained from it on the other side of the Atlantic; so the Pennsylvania manufacturer had to work out his own salvation, which he did, after several years of hard work, and an experience that hovered between prosperity and the Sheriff.

Finally in 1878, the problem was mastered; expert chemical and mechanical assistance was obtained from another young Pennsylvanian, John W. Eckert, who had just graduated from Lehigh University, and the combined efforts of these two men succeeded in establishing the first commercial and successful Portland Cement works in the United States. After the death of the original manufacturer, his associate became one of the principal officers of what is to-day the largest Portland Cement industry in this country—the American Cement Company—a company which has four large works, and has demonstrated its ability to make Portland Cement of a character equal to any imported, out of natural rocks, containing all the ingredients of a Portland Cement, and also out of marls and clays, which are the chemical equivalent of the chalk and clay of the English, and the marls and clays of the German and Belgian works. From small beginnings, for the company in question started by making but a few thousand barrels of Portland Cement per annum, it has now, after eight (8) years of experience, a capacity of over 1,500 barrels of Portland Cement per day. Its product is all uniform, and is all manufactured under improved and patented processes; for, without these, it would be impossible for the manufacturer in this country to compete with the cheap labor and cheap methods of Europe.

With the growth of the industry, it is only a question of a few years when the American Cement will command the market here, not only on account of its quality, which is fully equal to that of the best foreign grades, but also on account of the fact that it is manufactured by American manufacturers, sold by American commission merchants, and distributed by American jobbers, so that the consumer in buying it can, at all times, look to Americans for everything that is connected with the use and manufacture and distribution of the product.

The importance of Portland Cement in the construction of all large buildings, has very naturally and very properly led to the use of the foreign article, as long

J. A. Morris Building, New York, 1891.

Youngs & Cable, Architects. W. S. Harrison & Co., Contractors.

Foundation of "Giant" Egypt Portland Cement.

as no American manufacturer had been able to produce a cement which had had a long enough experience and a sufficient record in point of time to give it an equal standing with the foreign. It is certainly a very difficult thing for the manufacturer or for the dealer to induce an owner or architect to place a million dollar building upon a foundation, constructed with an untried and unknown cement. Such a thing would involve a hazard to all; and no matter how much the good will might be on the part of either architect or owner toward the manufacturer or dealer, neither of them would care to risk reputation or money in an undertaking of that character, and it is this obstacle that has largely met the American manufacturer in his efforts to introduce his product.

"All foreign cements are good," so far as the average consumer goes; it matters not whether it comes from a small works or a large one; from a works that has been running 30 years or one running only a week, so that the cement comes from Europe or bears a European label. "All American cements are bad" upon the same principle, though they may be made by manufacturers with abundant capital and abundant experience. It is to overcome these views and to impress upon the consumer and architect, that there is in this country an established industry of eight years of steady growth, that has a record for its Portland Cement in the largest buildings, the largest dams, the largest bridges, the largest aqueduct, the largest culverts and the most important works in this country; and that in purchasing "Giant" Portland Cement, made by the American Cement Company, of Egypt, Lehigh county, Penna., the buyer or architect is not buying an unknown product without standing or reputation, but is buying an article made by an old and well established concern with abundant capital and responsibility, and with a record second to none of the European manufacturers—that this book is written.

Certainly the photographs of buildings, dams, bridges, manufactures, sewers, railroad stations, costing in all nearly $100,000,000, which are printed herewith, coupled with the letters from leading architects, engineers, contractors and builders, show "Giant" Portland Cement to be no new thing, but to be reliable and trustworthy, and should convince every one that "Giant" Cement requires no further insurance than the record of its work, and the trust it has so well deserved and maintained.

After all, what is the difference between an American Portland Cement and a foreign Portland Cement? Is there any difference in the chemical ingredients of lime, silica and alumina, as found in Europe in the clays and marls and chalks of England and the Continent, or lias rocks of Rugby, and the lime, silica and alumina found in the argillaceous limestones, the marls, chalks and clays of the United States? And is there any difference in the product of American labor, well paid and prosperous, and that of the poorly paid and poorly fed labor of Europe?

Drexel Institute, Philadelphia. Built in 1891 exclusively with "Giant" Portland. See page 62.

Wilson Bros. & Co., Architects. Chas. McCaul, Contractor.

There is a very simple way of determining this question, and that is by applying the practical tests that are applied by all engineers and architects in the purchase of cement.

Given a specification requiring "the best Portland Cement," could "Giant" Cement be supplied under such a specification?

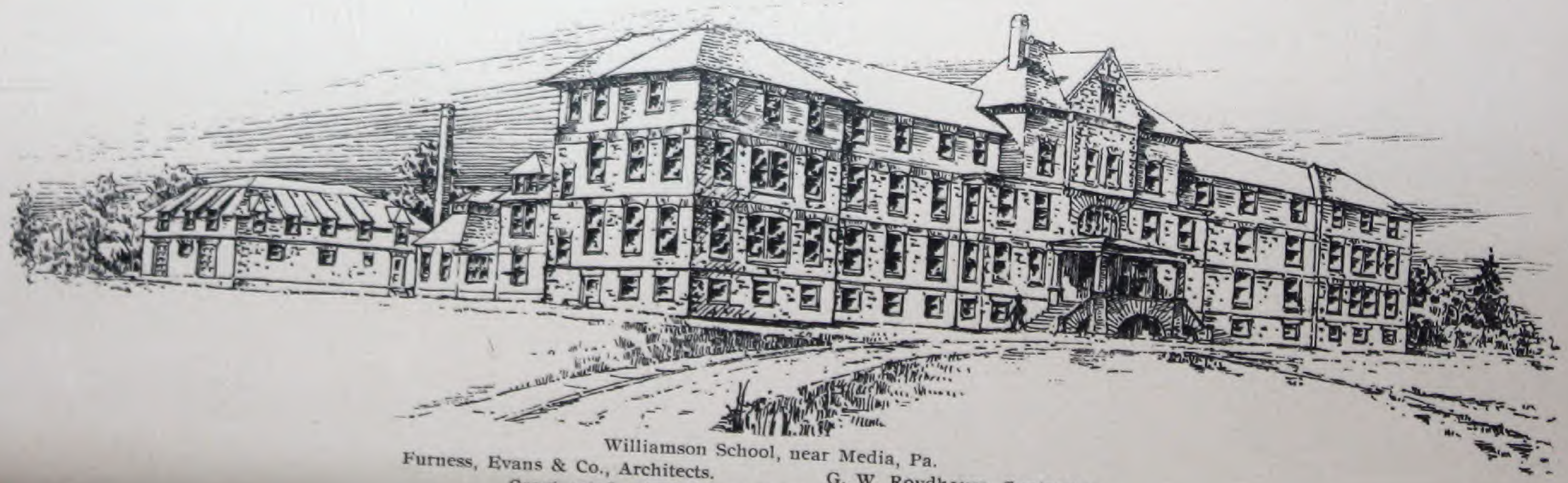
To determine the actual comparative value of any Portland Cement in comparison with other Portland Cements, three points should be properly considered.

Keystone Bank, Philadelphia.

"Giant" and "Union" Cements used. Willis G. Hale, Architect, 1889.

Jacob Meyer, Contractor.

Bryn Mawr Hotel, Bryn Mawr, Pa.
Furness, Evans & Co., Architects. G. W. Roydhouse, Contractor, 1890.
Constructed exclusively with "Giant" Portland Cement. See page 63.



Williamson School, near Media, Pa.
Furness, Evans & Co., Architects. G. W. Roydhouse, Contractor.
Constructed with "Giant" Portland, 1890. See page 63.

Tests of Portland Cement.

First. Testing by expert engineers for *fineness* and *tensile* strength.

Second. Chemical analysis by scientific chemists to determine whether chemically considered, the cement offered contains the ingredients of a true Portland Cement.

Third and last, but by no means least, the actual experience with the cement offered in practical work, covering a period of years, and under the conditions to which cement work is usually exposed, in reservoirs, dams, buildings, foundations, sewers, &c.

I. Scientific Tests by Engineers.

To best determine by what standard a cement should be judged, it is important to consider what results have already been obtained and what specifications a cement is required to meet. The largest number of breakings of cement in America were under Elliott C. Clarke, of the Boston sewerage system. His figures on Portland, as a result of all his tests, are below.

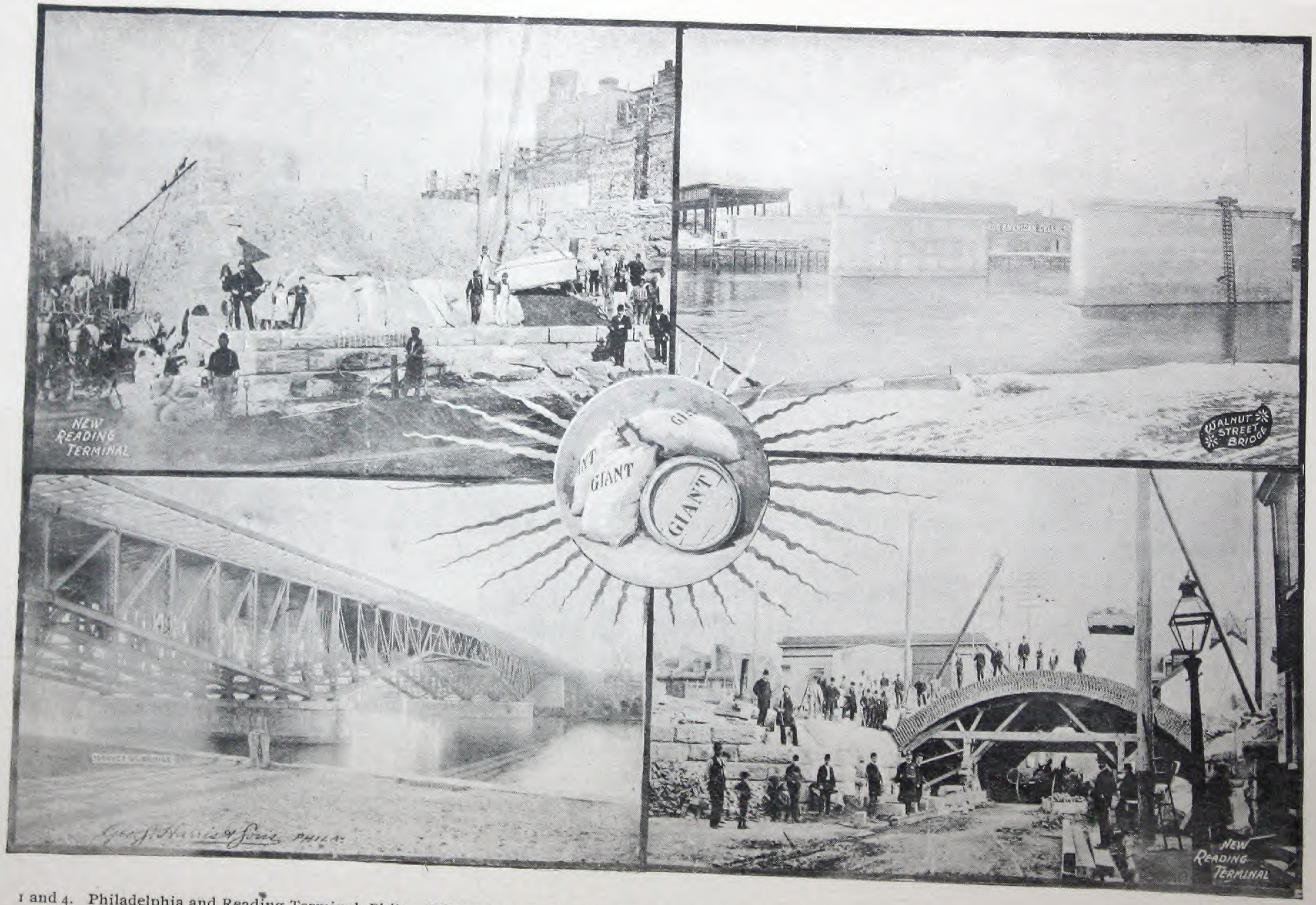
The next largest breakings are on the New York aqueduct, figures of which up to January, 1869, have been published. This showing of averages of all Portland, of all brands, is also given below:

ELLIOTT C. CLARKE.—*Average.*

	Neat.	1 Sand.
24 hours	102 lbs.	
7 days	305 "	136 lbs.
1 month	412 "	163 "
6 months	468 "	279 "
12 months	494 "	325 "

NEW YORK AQUEDUCT.—*Average.*

	Neat.	1 Sand.
24 hours	164 lbs.	92 lbs.
7 days	349 "	141 "
1 month	425 "	214 "
6 months	511 "	308 "
12 months	525 "	367 "



1 and 4. Philadelphia and Reading Terminal, Phila. Wilson Bros. & Co., Engineers. J. J. Ryan, Contractor. 25,000 barrels "Giant" used, 1891-92. See pages 43 and 62.

2. Walnut Street Bridge, Philadelphia—Shore Pier and Eastern Piers. S. L. Smedley, Chief Engineer. "Giant" and "Improved Union," 1890-91. R. C. Ballinger, Contractor. See page 34.

3. Market Street Bridge, Philadelphia. S. L. Smedley, Chief Engineer. R. A. Malone, Contractor. "Heyn," "Giant" and "Improved Union," 1889-90. See page

Specifications.

The following specifications of the American Society of Civil Engineers of the Pennsylvania Railroad and New York Aqueduct Commission, give an idea of what is required of Portland Cement :—

AMERICAN SOCIETY OF CIVIL ENGINEERS.

	NEAT.	1 TO 3 SAND.
24 hours	100-140 lbs.	80-125 lbs.
7 days	250-550 "	100-200 "
1 month	350-700 "	
1 year	450-800 "	

PENNSYLVANIA RAILROAD COMPANY.

	NEAT.	1 SAND TO 1 CEMENT.	2 SAND TO 1 CEMENT.
1 day	102 lbs.		
1 week	303 "	160 lbs.	126 lbs.
1 month	412 "	225 "	163 "
6 months.	468 "	347 "	279 "

NEW YORK AQUEDUCT COMMISSION.

	NEAT.	2 SAND 1 CEMENT
24 hours	110 lbs.	
7 days	300 "	125 lbs.
28 days	400 "	200 "

FINENESS.—20 per cent. to be retained on a sieve of 10,000 mesh to the square inch.

In view, therefore, of what is *required* of a standard Portland Cement, a statement is herewith submitted, giving a series of comparative scientific tests of "Giant" Cement with nearly a hundred brands of English, Belgian and German Cements, covering a period of several years, both of neat cement and cement and sand. The tests were made by such standard authorities on cement testing as De Smedt of Washington, Maclay of New York, Elliott Clarke of Boston, Colonel Canby of the Baltimore and Ohio Railroad, Schaeffer of Newark, Henry Faija of London, John Grant of the Metropolitan Board of Works, London ; the Department of Public Works, Philadelphia ; A. W. Steadman of the Lehigh Valley Railroad Company, and the Aqueduct Department of New York.

By a summary of all these figures it will be found that, in comparison with the hundred odd brands of foreign cements tested, that the "Giant" Cement excelled them all in fineness and tensile strength, both neat and with sand, at all periods from one week to two years. Further proofs of the increasing value of "Giant" Cement *mortar* are offered by the long-time tests of the New York Aqueduct Department, showing progressive growths for periods of two years, and also of tests at our own works, which show breaks at three to five years of over eleven hundred and twelve hundred pounds neat, and as high as eight hundred and twenty pounds two parts sand and one cement.

COMPARATIVE TESTS OF

"Giant" Portland Cement.

Below will be found a number of tests of the various brands of foreign and domestic Portland Cements, as shown by the reports from the various places mentioned. In addition to these will be found tests in this country and in England of the "Giant" brand, together with a summary of each test showing the comparative results.

The tests are for tensile strain at 7 days and 28 days for neat cement, and at 30 days for two and for three parts sand, and also at 1 year, 15 months and 2 years for two and three parts sand. Tests for fineness are also given.

The figures are as follows :

VARIOUS BRANDS PORTLAND.

7 Day Tests—Neat Cement—Inch Section.

PLACE.	Brand of Cement.	Tensile Strain.	Fineness on 2,500 Sieve.
United States Government Report, Cement Inspector, District of Columbia (De Smedt)	Saylor's (1883).	310 lbs.	80 per ct.
" " " "	Dyckerhoff (1886).	325 "	95 "
" " " "	White (1883).	355 "	86 "
" " " "	Alsen (1885).	289 "	97 "
" " " "	Brooks Shoobridge (1886).	350 "	92 "
New York Dept. of Docks (Maclay)	Star.	500 "	97 "
" " " "	Alsen.	359 "	98½ "
" " " "	Burham.	316 "	87½ "
" " " "	Saylor's.	312 "	90 "
" " " "	Gibbs.	280 "	90 "
" " " "	Francis.	184 "	
" " " "	Tingey.	212 "	
" " " "	Gillingham.	250 "	
" " " "	White.	264 "	
Boston City Sewage, average all test Portland	Brooks Shoobridge.	296 "	
Boston City Sewage, 1882 (Clarke)	Various brands.	303 "	
" " " "	Alsen.	333 "	90 "
" " " "	Brooks Shoobridge.	319 "	99 "
Baltimore & Ohio R. R., 1883 (Canby)	White.	353 "	92 "
" " " "	Alsen.	343 "	86 "
" " " "	Knight Bevan.	264 "	
" " " "	Casburne Lucas.	242 "	
" " " "	Imperial.	305 "	
" " " "	Robins & Co.	338 "	
" " " "	Burham.	338 "	
	White.	295 "	
New York Aqueduct, 1889, average of 57 brands, including every well-known make in England, Belgium, Germany and France	A'v'rge of 57 brands English, French, German, Belgium, American, over 300,000 bbls.	349 "	93.6 "

"GIANT" BRAND.

7 Day Test—Neat Portland—Inch Section.

PLACE.	Brand of Cement.	Tensile Strain.	Fineness on 2,500 Sieve.
United States Government Inspector, District of Columbia (De Smedt), Report for 1883	"Giant."	371 lbs.	100 per ct.
" " " Report for 1885	"	335 "	100 "
" " " " " 1886	"	380 "	100 "
Newark's Improved Drainage (Schaeffer), 1886	"	609 "	98 "
H. Faija, London (Faija), 1886	"	454 "	99 "
Department of Docks, N. Y. (Maclay), 1885	"	365 "	97 "
Boston Sewage (Clarke)	"	338 "	100 "
London, England (Grant, of Metropolitan Board of Works)	"	401 "	98 "
Private Tests, Philadelphia	"	313 "	100 "
Survey Department, Philadelphia (Paddock)	"	368 "	100 "
New York Aqueduct, 1889 to 1891	"	347 "	100 "

SUMMARY 7 DAY NEAT TEST.

Average all tests, various cements, 7 days neat, per square inch, 311 lbs.

Average all tests "Giant" Portland, 7 days neat, per sq. inch, 389 lbs.

VARIOUS BRANDS PORTLAND.

28 Day Test—Neat Cement—Inch Section.

PLACE.	Brand of Cement.	Time.	How Mixed.	Tensile Strain.
United States Government Inspector, District of Columbia (De Smedt), Report for 1883.	Saylor (1883).	30 days.	Neat.	390 lbs.
" " " Report for 1886.	Dyckerhoff (1886).	"	"	350 "
" " " " 1885.	White (1885).	"	"	364 "
" " " " "	Alsen (1885).	"	"	404 "
" " " " 1886.	Brooks Shoobridge (1886).	"	"	420 "
New York Dept. of Docks (Maclay)	Burham.	28 days.	"	332 "
" " " "	Francis.	"	"	374 "
" " " "	Tingey.	"	"	301 "
" " " "	Gillingham.	"	"	400 "
" " " "	Saylor.	"	"	413 "
Balt. & Ohio R. R., 1883 (Canby)	Alsen.	"	"	472 "
" " " "	Knight Bevan.	"	"	398 "
" " " "	Casburne Lucas.	"	"	348 "
" " " "	Imperial.	"	"	415 "
" " " "	Robins.	"	"	422 "
" " " "	Burham.	"	"	469 "
" " " "	White.	"	"	436 "
Met. Board Public Works, London (Grant)	All Brands.	"	"	302 "
New York Aqueduct, 1889, average of 57 brands, including every well-known make in England, France, Germany and Belgium	Average of 57 brands English, German, French, Belgian, American.	"	"	425 "

"GIANT" BRAND.

28 Day Test—Neat Portland—Inch Section.

London, England (Grant)	"Giant."	28 days.	Neat.	515.5 lbs.
United States Government Inspector, District of Columbia, Report of 1883 (De Smedt),	"	"	"	590 "
" " " Report of 1885.	"	"	"	400 "
" " " " 1886.	"	"	"	466 "
London (H. Faija)	"	"	"	540 "
Private Tests, Philadelphia	"	"	"	547 "
New York Aqueduct, 1889 to 1892	"	"	"	421 "

SUMMARY 28 DAY NEAT TEST.

Average all tests, various cement, 28 days neat, per sq. inch, 391 lbs.

Average all tests, "Giant," 28 days neat, per sq. inch, 497 lbs.

VARIOUS BRANDS PORTLAND.

28 Day Test—2 Parts Sand—Inch Section.

Place.	Brand of Cement.	Time.	How Mixed.	Tensile Strain.
United States Government Inspector, District of Columbia, (De Smedt.) Report, 1883	Saylor (1883).	30 days.	Two Sand One Cement	170 lbs.
" " " Report, 1886.	Dyckerhoff (1886).	"	"	260 "
" " " " 1885.	White (1885).	"	"	175 "
" " " " 1885.	Alsen (1885).	"	"	266 "
" " " " 1886.	Brooks Shoobridge (1886).	"	"	240 "
" " " " 1886.	Star (1886).	"	"	370 "
Boston City Sewage, 1882 (Clarke)	Alsen.	"	"	271 "
" " " "	Brooks Shoobridge.	"	"	239 "
" " " "	White.	"	"	220 "
Baltimore & Ohio R. R., 1883 (Canby)	Average all Brands.	"	"	163 "
" " " " "	Alsen.	28 days.	"	196 "
" " " " "	Knight Bevan.	"	"	110 "
New York Aqueduct, 1889, average of 57 Brands, as above stated.	White.	"	"	130 "
	Average all Brands.			204 "

"GIANT" BRAND.

28 Day Test—2 Parts Sand—Inch Section.

United States Government Inspector, District of Columbia, (De Smedt). Report, 1883	"Giant."	30 days.	Two Sand, One Cement	350 lbs.
" " " Report, 1885.	"	"	"	270 "
" " " " 1886.	"	"	"	279 "
New York Aqueduct, 1888 to 1892	"	"	"	277 "

SUMMARY 28 DAY TEST 2 PARTS SAND.

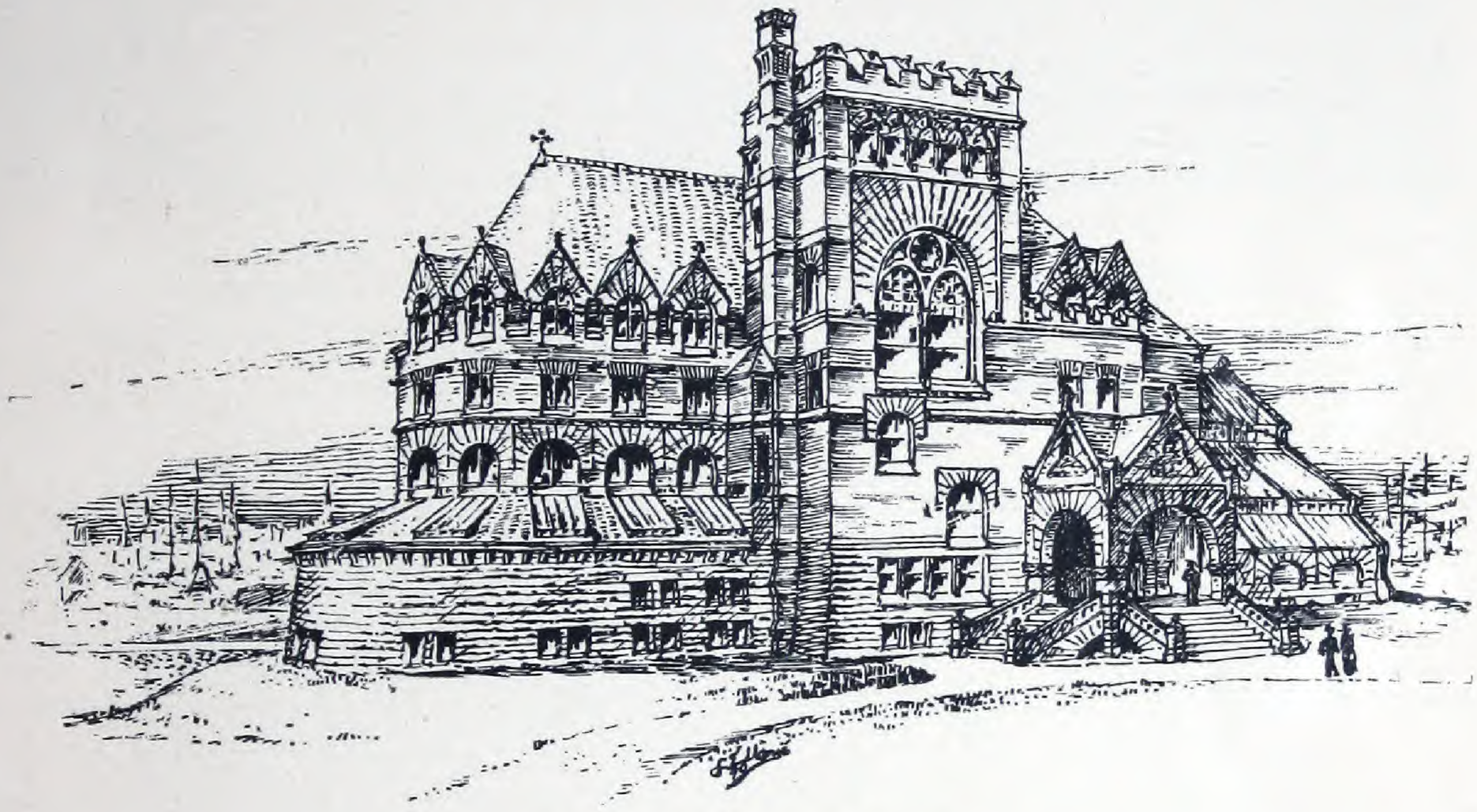
Average all tests, various cements, 28 days, 2 parts sand, 215 lbs.

Average all tests, "Giant," 28 days, 2 parts sand, 294 lbs.

VARIOUS BRANDS PORTLAND.

28 Day Test—3 Parts Sand—Inch Section.

Metropolitan Board Public Works, London (Grant).	All Brands.	28 days.	Three Sand, One Cement	25.7 lbs.
Boston City Sewage (Clarke) 1882.....	Alsen.	30 days.	"	148 "
" " "	Brooks Shoobridge.	"	"	132 "
" " "	White.	"	"	102 "
Baltimore & Ohio R. R., 1883 (Canby)	Alsen.	28 days.	"	124 "
" " " "	Knight Bevan.	"	"	75 "
" " " "	White.	"	"	96.2 "
New York Aqueduct, 1888 to 1891.....	Burham.	"	"	224 "



Philadelphia University Library.

Furness, Evans & Co., Architects, 1890. "Giant" Portland Cement, see page 63.

"GIANT" BRAND.

28 Day Test—3 Parts Sand—Inch Section.

PLACE.	Brand of Cement.	Time.	How Mixed.	Tensile Strain.
London England (Grant, of Metropolitan Board of Works).....	"Giant."	28 days.	Three Sand, One Cement	215.5 lbs.
New York Aqueduct, 1888 to 1892.....	"	"	"	211 "

SUMMARY 28 DAY TEST, 3 PARTS SAND.

Average all tests, various cements, 3 parts sand, per sq. inch, 115.9 lbs.

Average all tests, "Giant." 3 parts sand, per sq. inch, 213.3 lbs.

VARIOUS BRANDS PORTLAND.

One Year Test—2 Parts Sand, 1 Cement—Inch Section.

United States Government Inspector of Cements, District of Columbia, Report for 1885.	Alsen.	1 year.	Two Sand, One Cement	360 lbs.
" " " "	Dyckerhoff.	"	"	380 "
" " " "	Brooks Shoobridge.	"	"	385 "
New York Aqueduct, 1889, average all Brands	Average all Brands.	"	"	367 "

"GIANT" BRAND.

One Year Test—2 Parts Sand, 1 Cement—Inch Section.

United States Government Inspector of Cements, District of Columbia, Report for 1885.	"Giant."	1 year.	Two Sand, One Cement	425 lbs.
New York Aqueduct, 1888 to 1892.....	"	"	"	489 "

SUMMARY ONE YEAR'S TEST—2 PARTS SAND, 1 CEMENT.

Average all tests, various cements, 373 lbs.

Average all tests, "Giant" Cement, 457 lbs.

VARIOUS BRANDS PORTLAND.

Two Year Test—2 Parts Sand, 1 Cement—Inch Section.

New York Aqueduct, 1888 to 1891.....	Burham.	2 years.	Two Sand, One Cement	507 lbs.

"GIANT" BRAND.

2 Year Test—2 Parts Sand, 1 Cement.

New York Aqueduct, 1888 to 1891.....	"Giant."	2 years.	Two Sand, One Cement	575 lbs.

VARIOUS BRANDS PORTLAND.

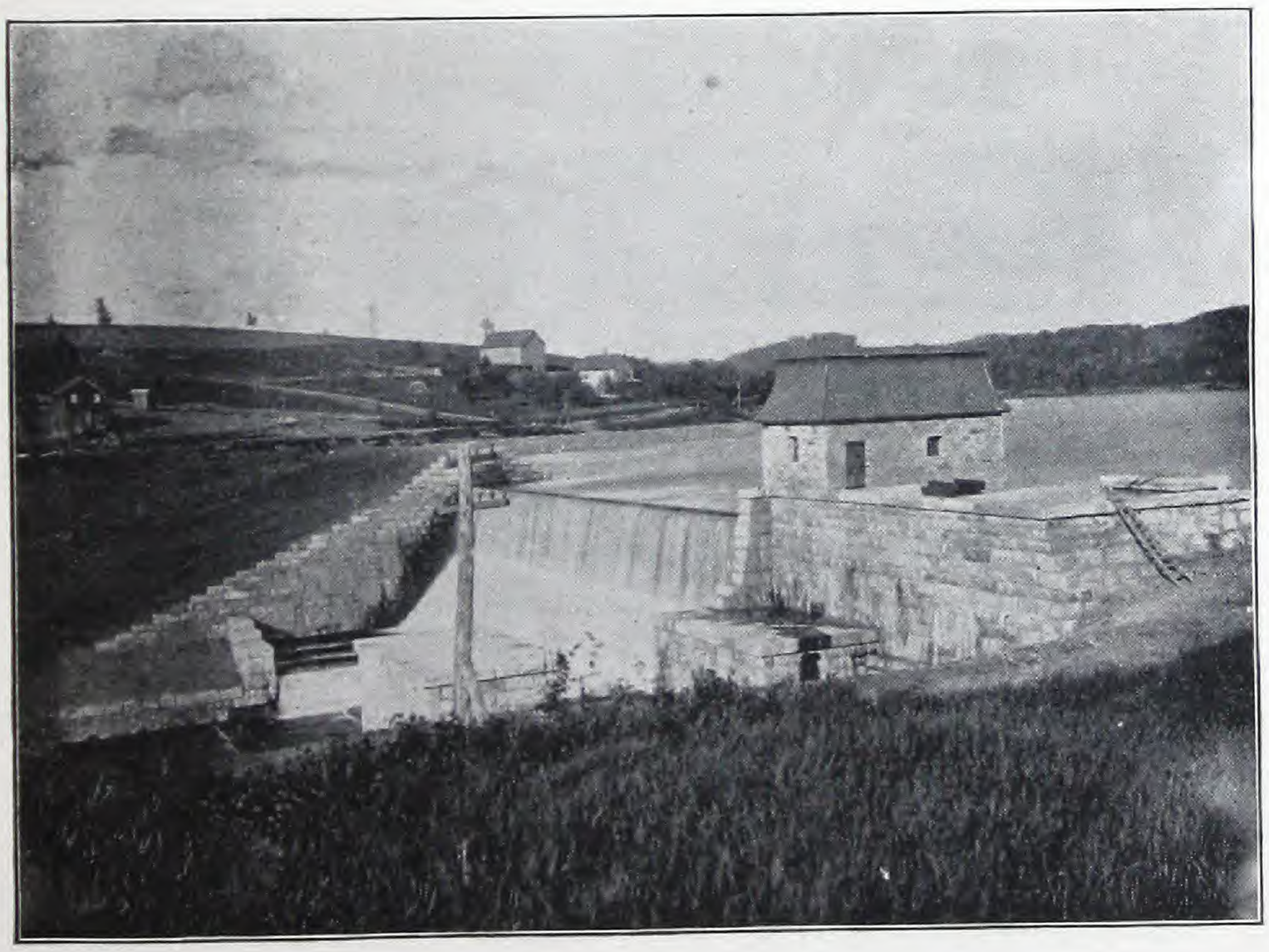
Fifteen Months Test—3 Parts Sand—1 Cement.

PLACE.	Brands of Cement.	How Mixed	Tensile Strain.
New York Aqueduct, 1888 to 1891.....	Burham.	3 Sand, 1 Cement	417 lbs.

Port Bowkly Bridge—Lehigh Valley Railroad.

Joseph Hendler, Contractor. A. W. Stedman, Chief Engineer.—1891-92.

Built with "Giant" and "Improved Union" Cements. See page 46.



Scranton Water Co.'s Gate House. See page 51.

R. S. Reeves and E. S. Gould, Engineers. Burke Bros., Contractors. 1889-90.

"Giant" and "Improved Union" almost exclusively used.

GIANT BRAND.

Fifteen Months Test—3 Parts Sand—1 Cement.

PLACE.	Brands of Cement.	How Mixed	Tensile Strain.
New York Aqueduct, 1888 to 1891.....	Giant.	3 Sand, 1 Cement	558 lbs.

In addition to and partly embraced in the above, the following copies of official tests of "Giant" Portland Cement made by leading authorities in this country and Europe, show it to be not only *equal* but *superior* to most of the English and German brands.

United States Government.

From the Annual Report for 1886, of Prof. E. J. DeSmedt, (Chemist, District of Columbia, and General Inspector of Cement and Asphalt Pavements), to Col. Wm. Ludlow, Engineer Commissioner, Washington, D. C.

"All the hydraulic cements used on the works of the District have been submitted at my laboratory to a daily test as to their tensile strength, and weekly reports of the results obtained, together with the places used, submitted to Captain Mahan and Lieut. Townsend.

"The following table shows the average tensile strength per square inch of Portland Cement in use here:

TABLE 2.—PORTLAND HYDRAULIC CEMENTS.

Name	Fineness sieve 50	Quantity of cement and sand	1 day	5 days	10 days	20 days	30 days	2 mths.	6 mths.	12 mths.	Remarks
Brooks & Shoobridge	6	Neat	100	305	350	380	420	560	620	737	Imported Cement
		2 sand									
		1 cement									
Dyckerhoff	5	Neat	95	250	150	200	240	250	300	385	" "
		2 sand			325	330	350	482	580	682	" "
		1 cement									
Star	3	Neat	200	450	165	172	240	276	302	360	" "
		2 sand			500	520	559	668	700	789	" "
		1 cement									
Giant	0	Neat	130	200	225	280	370	388	400	440	" "
		2 sand		300	380	400	466	563	600	746	American Cement
		1 cement			161	222	250	279	307	389	" "

"Hydraulic cements heretofore were sold on a reputation obtained through certificates given by persons having used many thousands of barrels, but some had never tried to discover by actual tests their comparative qualities.

"A prejudice in regard to Portland Cement is, that to be good, it must be imported. Portland Cement can be made, and is made in this country, of as good quality as manufactured elsewhere. The use of the testing machine will corroborate the correctness of my statement. In this office, the hydraulic cements are judged, accepted or rejected on their intrinsic merit."

"Giant" Cement in England.

Several years ago, T. C. McCollum, Esq., a prominent American Engineer and member of the American Society of Civil Engineers, sent a sample of "Giant" Portland Cement to Henry Faija, Esq., the leading English authority and writer on Portland Cement, for the purpose of having it tested in the latter's laboratory in comparison with the best English and Continental brands. The following official test sheet of Mr. Faija tells the story :

Portland Cement Testing Room & Laboratory.
4 Great Queen Street, Westminster.

To T. C. McCollum Esq. Testing No. 544-

Result of Tests & Report by Henry Faija.
Member of the Institute of Civil Engineers. Member of the Institute of Mechanical Engineers. Honorary Associate of the Royal Institute of British Architects. Author of Portland Cement for Users, &c.

Of a sample of Portland Cement Marked ——
Received from The American Improved Cement Co. 2
Egypt Pennsylvania on the 1st July 1885

Fineness { Residue when sifted through a No. 70 sieve 4.0 per cent
ditto ditto ditto 50 do 0.75 do
ditto ditto ditto —— do —— do

Tensile strength per square inch.

Water used for gauging 16.67 per cent. Briquettes placed in water 24 hours after gauging.
Strain applied at the rate of 100 lbs in 15 seconds in a Faija Testing Machine.

Three days Test			Seven days Test.			28 days Test.		
No 1.	broke at	320 lbs	No 1.	broke at	450 lbs	No 1	broke at	580 lbs
" 2	"	335 "	" 2	"	460 "	" 2	faulty	——
" 3	"	370 "	" 3	"	450 "	" 3	broke at	520 lbs
" 4	"	290 "	" 4	"	450 "	" 4	"	540 "
" 5	"	300 "	" 5	"	460 "	" 5	"	570 "
average		322 lbs	average		454 lbs	average		552 lbs

A slow setting Cement & well ground — This in my opinion a perfectly sound and safe Cement to use — and likely to acquire considerable strength.

Henry Faija Jun. Inst. C. E
15th September 1885.

Portland Cement Testing Room & Laboratory,
4 Great Queen Street, Westminster.

To J. C. McCallum Esq — Testing No. 544

Result of Tests & Report by Henry Faija
Member of the Institute of Civil Engineers. Member of the Institute of Mechanical Engineers.
Having Associate of the Royal School of Naval Architecture. Author of Treatises on Cements for Home &c.

Of a sample of Portland Cement Marked ~~[illegible]~~
Received from The American Imperial Cement Co of Coplay Pennsylvania on the 1st July 1886.

	7 Days	7 Days	28 Days	3 months	6 months	9 months	12 months
25 Briquettes	321	450	551	650	612	740	750
" 2	335	460	491	550	720	741	850
" 3	370	450	520	600	760	770	790
" 4	290	450	540	700	750	820	760
" 5	300	460	570	720	830	770	820
Average	322	454	540	644	741	770	784

The briquettes were in all instances ganged and tested in a similar manner to those described in my report under date September 18th 1885 - and were broken respectively at the periods mentioned after ganging and gave the results shown. They corroborate my report of September 18th 1885.

Henry Faija Mr. Inst. C. E.
8th July 1886

"Equal to English Portland."

In a letter of the same date, Mr. Faija, in summing up, says of "GIANT" CEMENT: "There is no doubt that it is a very good Cement, and certainly deserves to have a good sale. It seems to me quite equal to any of our English Cements."

II. Chemical Analysis by Scientific Chemists.

In the manufacture of Portland Cement the proper chemical analysis is most important, and a thorough method of determining the character of any cement to be used is by comparing its chemical analysis with that of other standard cements.

In his work on *Portland Cement*, Henry Reid of England, gives as an analysis of a high grade of Portland Cement the following, and Prof. E. J. De Smedt, Government Chemist, of Washington, and his successor, Prof. Richardson, give the following analyses of several cements :

HENRY REID.

Lime	60.0
Silica	25.0
Alumina and oxide of iron	12.0
Magnesia	1.0
Alkalies	1.0
Residue, etc	1.0
	100.0

ALSEN & SON (GERMANY.)

(*De Smedt.*)

Lime	59.98
Lost by calcination	2.16
Silica	24.90
Alumina and iron	11.22
Sulphuric acid	0.86
Magnesia	0.38
Alkalies	0.50
	100.00

BROOKS & SHOOBRIDGE.
(ENGLAND.)
(*De Smedt.*)

Silica	22.74
Alumina and iron	11.44
Lime	57.68
Magnesia	0.51
Alkalies	0.63
Sulphuric acid	0.60
Carbonic acid	3.50
Residue	0.53
Water	1.90
Loss	0.41
	99.94

KNIGHT, BEAVAN & STURGE,
ENGLISH CEMENT.

(*U. S. Gov. Chemist Richardson.*)

Water and carbonic acid	2.92
Uncombined clay	0.65
Combined silica	19.75
Alumina	7.48
Iron	5.01
Lime	61.38
Magnesia	1.28
Alkalies	0.75
Sulphuric acid	0.97
	100.19

Analysis of "Giant" Cement.

The following analyses of "Giant" Portland Cement, made by such eminent authorities as De Smedt, Faija, the University of Pennsylvania, together with an average analysis at our own works, show the chemical constituents of "Giant" Cement:

"GIANT."

(De Smedt, 1884.)

Loss by calcination	2.46
Silica	23.36
Alumina	8.07
Oxide of iron	4.83
Lime	59.28
Magnesia	1.00
Alkalies	0.50
Sulphuric acid	0.50
	100.00

"GIANT."

Henry Faija, London, 1885.

Lime	61.37
Silica	22.45
Alumina and iron	13.23
Sulphuric acid	1.37
Magnesia	0.66
Alkalies	0.71
	99.79

"GIANT."

University of Pennsylvania, 1888.

Silica	20.99
Alumina	4.12
Oxide of iron	5.18
Phosphoric oxide	1.17
Lime	60.75
Magnesia	0.41
Alkalies, organic matter, sulphuric acid	7.40
	100.02

"GIANT."

Our Works, 1890.

Silica	22.90
Alumina and iron	12.10
Lime	60.13
Alkalies, magnesia, sulphuric acid	4.20
	99.03

By the application of these tests it will be found that "Giant" Portland Cement contains practically the same chemical ingredients as the best English and German Portland Cements, and that the analysis of De Smedt, in 1884, of Faija, in 1885, of the University of Pennsylvania, in 1888, and of our own works in 1890, of "Giant" Portland vary but in a slight degree, thus showing our regularity and care during a series of years in the manufacture of this *artificial* Portland Cement.

III. Practical Test of "Giant" Cement in Work.

Upon this point it may be stated that "Giant" Portland Cement has been used to the extent of several hundred thousand barrels, in important work, all over the United States, since the year 1884; that the large main sewer in Newark used it

Germania Building, New York.—1891.

Lamb & Rich, Architects. Robinson & Wallace, Builders.

Foundation of "Giant" Portland Cement.

exclusively, in the cradle and bottom brick work, in 1884; that the city of Philadelphia has used it almost continually since 1884, for sewers, foundations, bridges, and other difficult work; that the numerous bridge foundations on the Pennsylvania Railroad (among them the celebrated JOHNSTOWN BRIDGE, which stood the flood), the Lehigh Valley Railroad, the Philadelphia and Reading Railroad, and

the Baltimore and Ohio Railroad have within the past six years been put in with "Giant" Cement; that nearly all the cable lines of Philadelphia and Pittsburg are built of "Giant" Cement, which has stood the enormous traffic of the most populous streets in the two cities; that the three dams of the Scranton Water Company at Scranton are constructed almost exclusively with "Giant" Cement; that the large iron works of the North Branch Steel Company, the William Wharton Switch Company, Cambria Iron Company, Midvale Steel Company, Carnegie Brothers & Co., Mahoning Rolling Mills, and the Thomas Iron Company have used many thousand barrels of "Giant" Cement within the past five years; that the main sewers of Pittsburg and New York are constructed with "Giant" Portland Cement; and that the largest dam on the New York aqueduct at Sodam, is also almost entirely built with this cement; and that the DREXEL BUILDING, almost the largest office building in this country, is built with "Giant" Cement.

At the present time this cement is being used by the Pennsylvania Railroad Company on their new Jersey City Station, and on all their work; by the Philadelphia and New York Sewer Departments on all their sewers; by the Carnegie Steel Works; the Mahoning Rolling Mills; the Lehigh Valley and Philadelphia and Reading Railroads; the new CRIMINAL COURT BUILDING, New York; new ASTOR HOTEL, Thirty-third street and Fifth avenue; the new Senmler Glass Works, Irwin, Pa.; the new Reading Terminal in Philadelphia, Broadway (N. Y.) Cable Road, and on *all* the new dams of the Croton aqueduct system of New York Aqueduct Commission, as follows: Sodam, Bog Brook No. 1, Bog Brook No. 2, Carmel and Purdy's (the latter the largest dam in the United States). On the aqueduct work it has a record for nearly four years, surpassing all the fifty or more brands of English, German, French and Belgian Cements used there.

In conclusion and in substantiation of the claim that this cement in practical work is fully equal to the best imported brands, it may be stated that out of the hundreds of thousands of barrels shipped, not a single barrel has ever been returned to the works, and that the following letters from such eminent engineers and architects as Wilson Bros. & Co., Col. H. T. Douglas, Chief Engineer Baltimore and Ohio Railroad; Joseph Flannery, Gas Engineer; Thom & Wilson, Carroll Philips Bassett, A. P. Boller, Alexander McGaw, Cofrode & Saylor, George B. Burbank, Consulting Engineer Niagara Construction Company; Alex. C. Humphreys, General Manager United Gas Improvement Company; Rudolph Hering, A. W. Steadman, Chief Engineer Lehigh Valley Railroad Company; Clemens Herschel; George Rice, Chief Engineer Traction and Citizens' Railway Company, Pittsburg; Joseph T. Richards, Assistant Chief Engineer Pennsylvania Railroad; Col. H. K. Nicols, Chief Engineer Philadelphia & Reading Railroad Company, together with many others selected from the hundreds in our possession, all bear unqualified evidence to the practical working of "Giant" Portland Cement.

Sewers and Public Works.

WASHINGTON,
ELIZABETH,
PHILADELPHIA,

PATERSON,
BALTIMORE,
NEWARK,

READING,
ALLENTOWN,
SCRANTON,

EASTON,
NEW YORK,
PHILLIPSBURG,

PITTSBURG,
ORANGE,
YORK,

HARRISBURG,
BETHLEHEM,
WILKESBARRE.

BROOKLYN, CHESTER, PA.

WALNUT STREET BRIDGE, PHILA.

MARKET STREET BRIDGE, PHILA., NEW CRIMINAL COURT, N. Y.

ENGINEER DEPARTMENT.

Laboratory of the Chemist.

WASHINGTON, D. C., January 25, 1887.

R. W. LESLEY,

Secretary and Treasurer of the American Improved Cement Co.

DEAR SIR:—In reply to yours of the 24th, I have to state that your Portland Cement, under the name of Standard Portland "Giant" brand, has been in use on sewer and other public works in the District for nearly three years, during all of which time it has been tested by me in this office. The figures of the tests show, in my official reports for 1883, 1884, 1885 and 1886, strength and uniformity of the cement, and give about 130 pounds at 24 hours, 350 pounds at 7 days, and 740 pounds at 1 year. Mixed two parts sand and one part cement, gave 400 pounds, with briquettes 1 x 1 inch. So far as my experience goes, as compared with foreign brands, such as Dyckerhoff, White, Alsen, Brooks & Shoobridge, etc., it is fully their equal.

I consider "Giant" Portland a perfectly safe cement to use on large important hydraulic works of any kind, under or above water. My experience with this cement, and my comparative analyses with the best imported Portland Cements, give me positive proofs that this cement is of a best quality, and it gives me pleasure to say, that as good Portland Cement is made here to-day by your company as can be made in Europe.

Truly yours,

E. J. DE SMEDT.

DEPARTMENT OF SURVEYS.

CITY HALL, BROAD AND MARKET STS., E. ENTRANCE.

SAMUEL L. SMEDLEY,

CHIEF ENGINEER AND SURVEYOR.

PHILADELPHIA, January 29, 1886.

AMERICAN IMPROVED CEMENT CO.:

GENTLEMEN:—We have been using your Improved "Union" Cement in large quantities, on both main and branch sewers since 1884.

All cements used by the department are tested on the machine, and in the work, and judging from the results obtained I can freely say for the Improved "Union" that it has given perfect satisfaction in every respect. It sets well under water, and where exposed to atmospheric and climatic changes, it remains unaffected.

Every year we have raised the standard of test, and the Improved "Union" has met the requirement.

What I have said in reference to your Improved "Union" applies with equal force to "Giant" Portland, which we have used for the past two years in cases where Portland Cement was required by our specifications. I think it compares favorably with the best foreign Portland.

Very truly yours,

J. KAY LITTLE,

Assistant Engineer in charge of Sewer Construction

RUDOLPH HERING,
CIVIL AND SANITARY ENGINEER,
31 Charles Street.

NEW YORK, October 12, 1888.

R. W. LESLEY, ESQ.:

DEAR SIR:—Replying to your letter, I will say, when I see the gentlemen, that I always found the "Union" and "Giant" Cements both of good quality, and that I never had any fault to find with them. Yours truly, [SIGNED.] RUDOLPH HERING.

OFFICE OF NEWARK'S IMPROVED SEWERAGE.
HEATH BUILDING.

R. W. LESLEY, NEWARK, January 18, 1887.
Secretary and Treasurer American Improved Cement Co.:

DEAR SIR:—We have used about 5000 barrels of your "Giant" Portland Cement, and about 15,000 barrels of Improved "Union" (common) Cement. Some of the work has been finished for two years, and the cements have given entire satisfaction. Our tests before using are, for Portland, 400 pounds in 7 days; and for common, 60 pounds in 24 hours (tensile strength per inch section), the briquettes are allowed to remain in air until set, due regard being paid to fineness and proper proportion of lime.

The above cements are not excelled by any in this market for fineness, several other brands having been tested and used on this work. Yours respectfully, J. S. SCHAEFFER,
Engineer and Superintendent.

JOHN O. MERRITT,
GENERAL CONTRACTOR: WATER WORKS, RAILROADS AND LEVEES.
CRUSHED STONE FOR RAILROAD, BALLAST AND MACADAM.
WHITE PLAINS, WESTCHESTER CO.

UNITED BUILDING MATERIAL CO., NEW YORK, September 21, 1891.
No. 54 Pine Street, New York City:

GENTLEMEN:—Four cars of 100 barrels of "Eagle" Portland Cement received Saturday, 18th inst. Please ship me one car "Egypt" Portland, and one car "Union" Cement. I prefer the "Egypt" to any other brand of Portland Cement you have sent me.

Yours truly, [SIGNED.] F. H. MERRITT.

SEWERAGE CONSTRUCTION,
CARROL PH. BASSETT, CHIEF ENGINEER,
Cor. Day and Snyder Streets.

ORANGE, N. J., Nov. 23, 1891.

MR. C. M. HARRIS:

MY DEAR SIR:—The results recently reported by Fairbanks & Co., of tensile strain on briquettes of "Giant" Portland, are entirely satisfactory, both neat and sand mixed. Shipments of similar quality will pass inspection on the works here.

Very truly yours, CARROL PH. BASSETT.

DEPARTMENT OF SURVEYS.

CITY HALL, BROAD AND MARKET STS., E. ENTRANCE.

SAMUEL L. SMEDLEY,

CHIEF ENGINEER AND SURVEYOR.

PHILADELPHIA, January 28, 1887.

MR. JOHN W. TRINKLE:

DEAR SIR:—We have been using the "Giant" Portland Cement on our work for some time; it is working very satisfactorily. Every carload received is tested. The briquettes are one inch square, left in the air 24 hours, and 6 and 13 days in water. The breakage has been

Photograph by R. Newell & Son.

Public Buildings, Broad and Market Streets, Philadelphia.

J. McArthur, Jr., Architect. "Giant" Portland and "Union" and Rosendale used 1885 to 1892.

pretty uniform for 7 days, between 350 and 400 pounds; for 2 weeks, from 550 and 600 pounds, and sometimes more. I haven't a doubt but it will supersede most of the foreign cements, a large quantity of which I have tested in the last four years.

Yours truly,

GEO. H. PADDOCK,

Engineer in charge of the Intercepting Sewer.

DAWSON & ARCHER,

MASONS AND BUILDERS, NO. 236 E. THIRTY-FIFTH STREET.

NEW YORK, January 15, 1891.

UNITED BUILDING MATERIAL CO.:

GENTLEMEN:—In reply to your inquiry regarding the quality of your "Giant" Portland Cement, we will say, that we used about eight thousand barrels of it during the past season, in the construction of the foundation of the new Criminal Court Building. The cement was used largely under water, and was previously carefully tested by the architects, and continuously

New Criminal Court House, New York. 1890-91.

Thom & Wilson, Architects. Dawson & Archer, Contractors.

Concrete, stone and tile work in "Giant" "Egypt" Portland Cement—8000 bbls.

tested during the work by the engineers of the Department of Public Works. The result being that the cement was found to be uniformly of an excellent quality and entirely satisfactory to all concerned. We should not hesitate to use or recommend it for any character of work, and will say, that for brick work especially, it produces an easily handled mortar that facilitates the work in laying it up. We consider it an A 1 Portland Cement.

Respectfully yours,

DAWSON & ARCHER.

THOM & WILSON,
ARCHITECTS, NO. 1267 BROADWAY.

NEW YORK, January 16, 1891.

UNITED BUILDING MATERIAL CO.:

GENTLEMEN:—We used your "Giant" Portland Cement entirely in the foundation of the new Criminal Court Building, and found it very satisfactory.

Harlem Court House, New York.
Thom & Wilson, Architects. 1890. Built with "Giant" Egypt Portland.

The engineers of the Department of Public Works made continuous tests from time to time, and agreed with us that the cement was reliable in every way.

Respectfully yours,

[SIGNED] THOM & WILSON.

Cable Roads—Street Work.

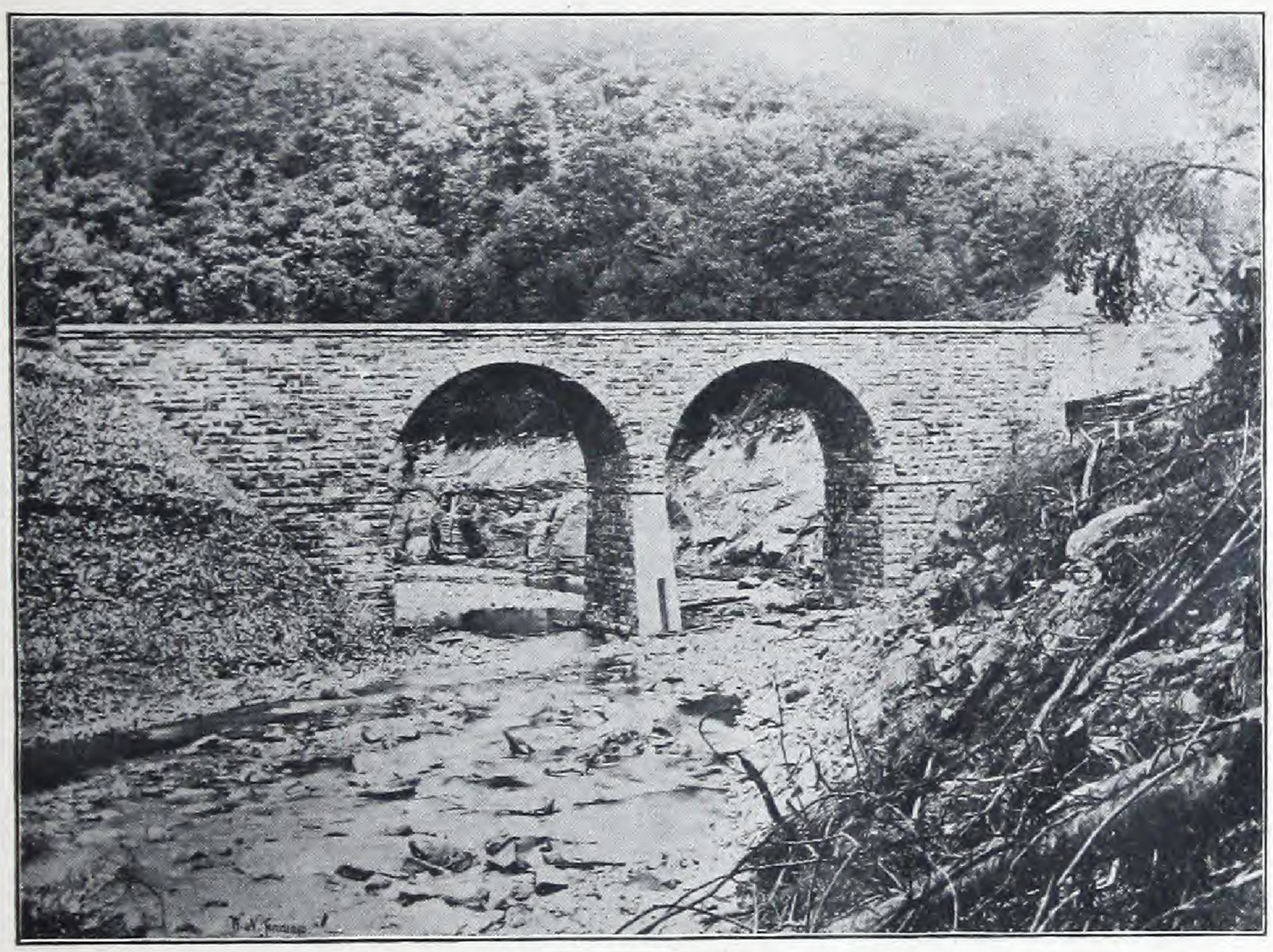
CITIZENS' TRACTION CO.—CENTRAL TRACTION CO.

OFFICE OF CHIEF ENGINEER.

PITTSBURGH, October 1, 1888.

MESSRS. LESLEY & TRINKLE, PHILADELPHIA:

GENTLEMEN:—I take pleasure in responding to your request of the 29th ult., for an opinion on the merits of your "Giant" Portland Cement. We have used over 20,000 barrels of this cement during the past season, and of the 6,000 lineal feet that has been put in, we have had to renew less than 50 feet, and in this the damages were done by paving over the concrete before it had time to set. I know of no street in this country that has a heavier traffic on it than Penn avenue, and the structure has been put to the severest tests, both longitudinally and transversely. When consideration is taken that the walls of the conduit are in the narrowest part but



Pennsylvania R. R. Viaduct near Johnstown.
Chief Engineer, W. H. Brown, and Assistant Chief Engineer, J. T. Richards. Contractors, Drake, Stratton & Co.
"Giant" and "Improved Union."—1890-91. See page 41.

10 inches thick, and in height about 3 feet 2 inches, I feel that I am fully justified in giving you the highest endorsement. Soon after the work was started the concrete mixer broke loose on a grade of five per cent., ran on the track some 150 feet before jumping, and then over the concrete without damaging it a particle. I have had a large experience with cement work, and would unhesitatingly use your "Giant" Cement in any future work with the fullest confidence. You may refer to me at any time if I can be of any service to you.

Fifteen thousand barrels additional supplied on the work in the season of 1889, and 20,000 barrels in 1889–'90.

Very truly yours,

GEORGE RICE.

Chief Engineer.

DR. L. S. FILBERT, PRESIDENT. D. L. FISHER, TREASURER.

OFFICE OF THE VULCANITE PAVING CO.

STUART'S PATENT GRANOLITHIC AND ARTIFICAL STONE IN ANY DESIGN OR COLOR A SPECIALTY.

1902 GREEN STREET.

PHILADELPHIA, PA., January 14, 1885.

MESSRS. LESLEY & TRINKLE:

GENTLEMEN:—We have used some 3,000 or 4,000 barrels of "Union" Cement, made by the American Improved Cement Company, at Egypt, Pa., and find it superior in strength to any of the Rosendales, in fact, better than any of the common cements heretofore used by us.

We have also used a considerable amount of the Standard Portland "Giant" brand made by the same company, with the very best results, and in fact consider it equal if not superior to most of the foreign Portland Cements. Very respectfully, L. S. FILBERT,

President Vulcanite Paving Co.

WILLIAM WHARTON, JR. & CO., LIMITED,

ENGINEERS, FOUNDERS AND RAILROAD CONTRACTORS,

Office and Works, 25th St. and Washington Ave.

PHILADELPHIA, January 18, 1887.

R. W. LESLEY, ESQ.,

Secretary and Treasurer American Improved Cement Co., 216 S. Third St., Phila.

DEAR SIR:—We have from time to time used considerable quantities of cement furnished by you, and it has given us satisfaction. Our last use of your "Giant" brand was in the building of concrete piers for track in the grain elevator at Port Richmond; and our foreman reports to us that your cement was more satisfactory in every respect than the imported.

Yours truly, WM. WHARTON, JR. & CO., LIMITED.

Largest Train Shed in the World—Pennsylvania Railroad, Jersey City, N. J.
W. H. Brown, Chief Engineer,—1890–91. Contractors, B. M. & J. F. Shanley.
20,000 bbls. "Giant" Portland used in concrete foundation of Station, and two miles of Elevated Terminal Railway. See pages 41 and 42.

Railroads.

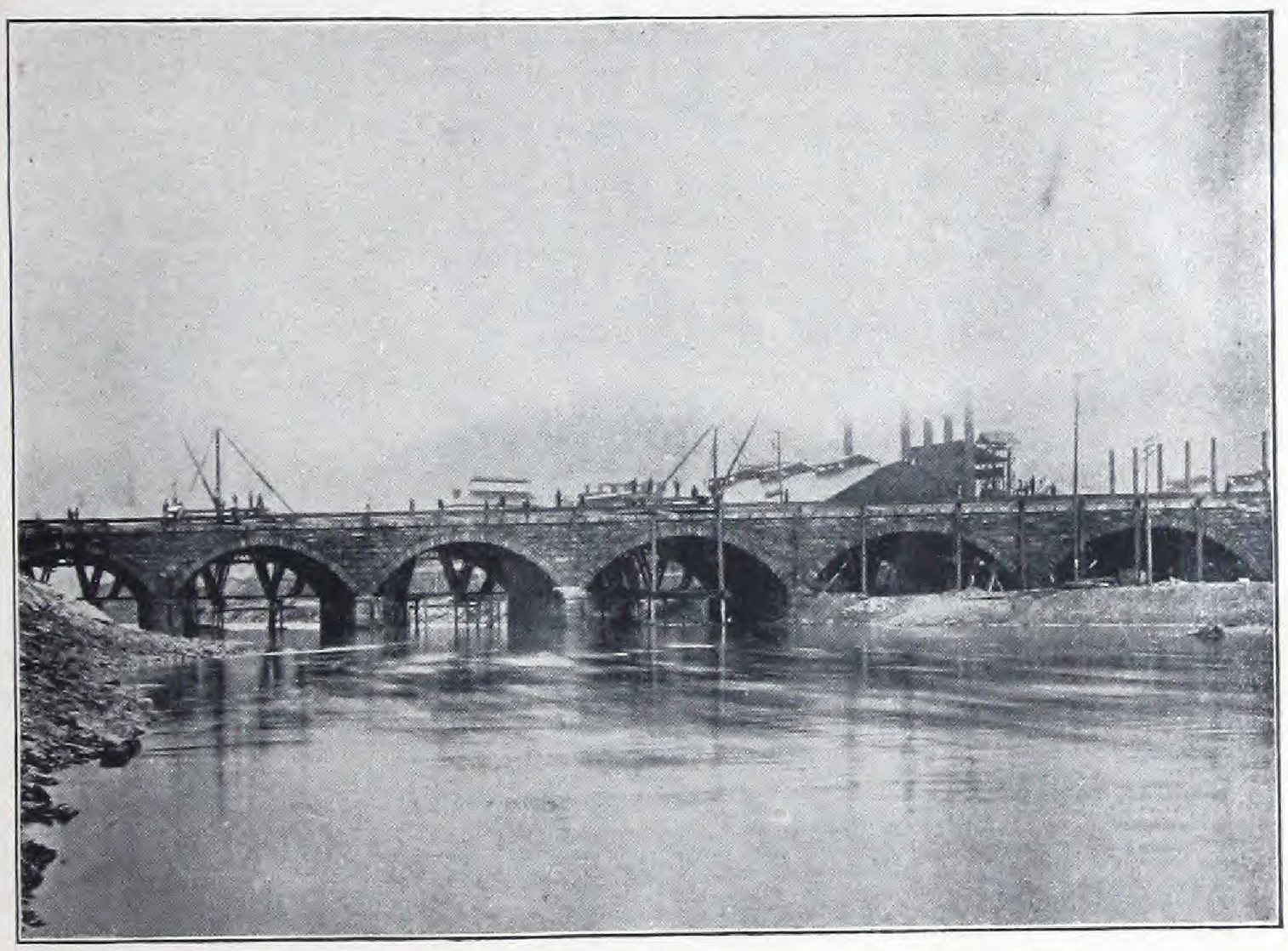
PENNSYLVANIA RAILROAD COMPANY.

OFFICE CHIEF ASSISTANT ENGINEER.

PHILADELPHIA, October 2, 1888.

G. B. BURBANK, ESQ.,
Division Engineer, N. Y. Aqueduct.

DEAR SIR:—In answer to your inquiry of the 1st, would beg to state that we have for some years past used the "Union" Cement of the AMERICAN CEMENT COMPANY. We have very much the same result you quote, of its "standing a good test for fineness, a tensile strain, etc.;" and we also find that it has stood the elements of our climate very well, in structures that have been completed a number of years.



Pennsylvania R. R. Johnstown Bridge.

The Historic Bridge that "stood the Johnstown Flood."
Engineers, W. H. Brown and J. T. Richards. Contractors, Sparks & Evans.
Built in 1889 with "Giant" and "Union" Cements exclusively.

I enclose you list, giving some of the stone and brick arch bridges on our line in which it has been used, and you are at liberty to visit and inspect them, which would probably be the most satisfactory way for you to get a correct knowledge of its character. We have also used the "Giant" Portland Cement, manufactured by the same company, and with equal success.

Yours truly,

[SIGNED.] JOSEPH T. RICHARDS,
Assistant Chief Engineer.

Partial List of Bridges in which the Cement of the AMERICAN IMPROVED CEMENT COMPANY was used:

Elizabeth River Bridge, West of Elizabeth, New York Division.
Frankford Creek Bridge, East of Holmesburg, New York Division.
Poquesing Creek Bridge, East of Torresdale, New York Division.
Fifty-sixth Street Bridge, East of Overbrook, Philadelphia Division.
Big Conestoga Creek Bridge, West of Witmer, Philadelphia Division.
Swatara Creek Bridge, East of Middleton, Philadelphia Division.
Tuscarora Creek Bridge, East of Port Royal, Middle Division.
Little Juniata Bridge, No. 8, East of Shoenberger, Middle Division.
Little Juniata Bridge, No. 9, West of Shoenberger, Middle Division.
Little Conemaugh Bridge, No. 1, East of Summaerhill, Pittsburg.
Little Conemaugh Bridge, No. 2, East of Summaerhill, Pittsburg.
Little Conemaugh Bridge, No. 3, East of Summaerhill, Pittsburg.
Little Conemaugh Bridge, No. 4, East of Summaerhill, Pittsburg.
Johnstown Bridge (which "stood" the flood).

Respectfully, J. T. RICHARDS,
Assistant Chief Engineer, Penna. R. R. Co.

Since the above was written the following large work, as well as practically all other new work, were done with our cements:

New Viaduct, near Johnstown.
New Bridge, No. 7.
New Little Conemaugh Bridge, No. 6.
All Bridge Masonry on "Trenton Cut-off."
New Jersey City Terminal and Station.

B. M. & J. F. SHANLEY,
ROAD BUILDERS AND CONTRACTORS,
OFFICES:—1429 Market Street, Philadelphia.
16 Exchange Place, Jersey City.
867 Broad Street, Newark, N. J.

AMERICAN CEMENT COMPANY,
220 South Third Street, Philadelphia, Pa.

JERSEY CITY, N. J., January 26, 1892.

GENTLEMEN:—We began the use of your "Giant" Portland and "Improved Union" Cements in the construction of the main intercepting sewer for the City of Newark, N. J., in the year of 1884, and used between 40,000 and 50,000 barrels of the cement in that work, and in other sewer work in the City of Newark, from 1884 to 1886.

Since 1884 we have used your "Giant" Portland and "Improved Union" Cement, in all the bridge masonry, arches, viaducts and other work that we have been doing for the past eight (8) years for the Pennsylvania and Lehigh Valley Railroads in the State of New Jersey.

The last and largest piece of work upon which we used the cement was the Terminal Station of the Pennsylvania Railroad Company at Jersey City; the span of the depot shed being the largest single span train shed in the world. This shed is built and sustained upon piers and walls laid upon pile foundation driven in the mud, and the concrete foundations laid around the piling was of "Giant" Portland Cement. We take pleasure in stating that in all these years' experience, we have had entire satisfaction with the working, durability and permanence of the brands of cement above mentioned.

Yours truly, (Signed) B. M. & J. F. SHANLEY.

BALTIMORE & OHIO RAILROAD CO.
OFFICE OF CHIEF ENGINEER.

MR. R. W. LESLEY, BALTIMORE, August 9, 1888.
Secretary and Treasurer of American Improved Cement Co. :

DEAR SIR :—I beg to acknowledge the receipt of your letter of August 7th. The Improved "Union" Cement and "Giant" Portland Cement of your company used by us has given entire satisfaction, and I will be glad to see it used in Richmond on the work at that point.

Yours truly,

H. T. DOUGLAS,
Chief Engineer.

Baltimore & Ohio Railroad—Gray's Ferry Bridge, Philadelphia.
H. T. Douglass, Chief Engineer. Drake, Stratton & Co., Contractors.
Built with "Giant" and "Improved Union" and "Alsen" Cements.—1886-87.

JAMES J. RYAN,
CONTRACTOR, 1126 NORTH FORTIETH STREET.

PHILADELPHIA, March 14, 1887.

AMERICAN IMPROVED CEMENT CO. :

DEAR SIRS :—I have used about 30,000 barrels of your Improved "Union" Cement, and also several hundred barrels of your "Giant" Portland Cement in construction of Pennsylvania Avenue Section of Baltimore and Ohio tunnel. I can cheerfully recommend both brands to be equal to any American manufacture of cement, and to be first-class articles.

Truly,

[SIGNED] JAMES J. RYAN.

Used 25,000 barrels "Giant" on Reading Terminal, Philadelphia, 1891.

OFFICE OF
DRAKE & STRATTON,
CONTRACTORS, NO. 71 BROADWAY.

R. W. LESLEY, ESQ., NEW YORK, March 10, 1887.
Secretary and Treasurer:

DEAR SIR:—During the past eighteen months we have used some 50,000 barrels of Improved "Union" Cement, and 500 barrels of "Giant" Portland, manufactured by your company, in the construction of the Schuylkill River bridge and the Callowhill Street tunnel, for the Baltimore and Ohio Railroad Co.; we have also used a large quantity of your Improved "Union" Cement on the Pottsville tunnel and important bridge work on the Pennsylvania and Schuylkill Valley Railroad, and it gives us pleasure to say that we have found both cements first-class in every respect. The Improved "Union" Cement fully equaling Rosendale Cement, and the "Giant" Portland most brands of foreign Portland.

Yours truly,

Pittsburg Office, 111 Fourth Avenue. DRAKE & STRATTON.

LEHIGH VALLEY RAILROAD CO.
OFFICE OF CHIEF ENGINEER.

MAUCH CHUNK, PA., August 4, 1888.

R. W. LESLEY,
Secretary and Treasurer American Improved Cement Co., Philadelphia.

DEAR SIR:—The work for which we desire this cement is the lining back of arch in one of our tunnels, which we propose to do this fall, in New Jersey, by putting in about 4 feet of concrete, and if you can furnish thoroughly seasoned "Giant" Cement, that will be slow setting, I will order the cement of you. I will require 2,000 to 4,000 barrels probably, and will begin in 30 days, perhaps sooner, to use some cement.

My idea is to get a slow setting cement, whose maximum strength will not be reached in one or two years, and then recede, as many quick setting cements appear to do. If the common cements are better in this respect, would take them.

Yours truly,

A. W. STEDMAN,
Chief Engineer.

LONDON & SOUTHWESTERN RAILWAY,
STORES DEPARTMENT, WANDSWORTH ROAD, S. W.

R. W. LESLEY, ESQ., LONDON, January 22, 1887.
American Improved Cement Co., 216 South Third Street, Philadelphia:

DEAR SIR:—With reference to our Chief Engineer's letter to you of the 20th instant, I shall be glad, if you will be good enough to inform me the price of the "Giant" Portland Cement, delivered, carriage paid, alongside the company's wharf, in the Thames, at Pine Elms.

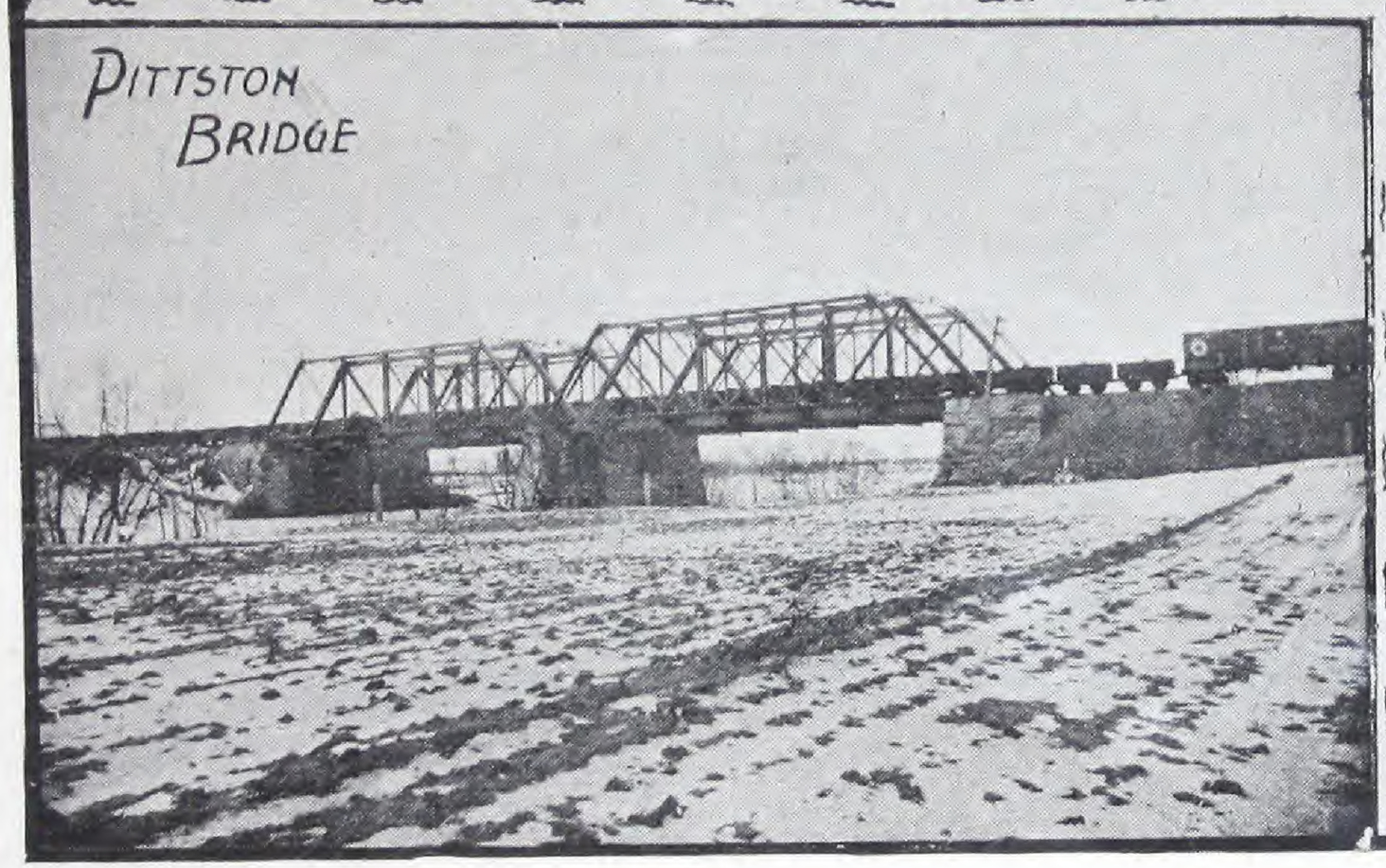
Will you also be good enough to say whether the price would be for delivery in bags or in casks, and what quantity each bag or cask would contain.

Upon receipt of your reply, I will communicate its purport to Mr. Jacomb, Chief Engineer, and shall doubtless be in a position to write you again shortly. In the meantime, do not forward any cement until you receive my official order to do so.

Yours truly,

JOHN B. BARRETT,
Purchasing Agent.

Fifty barrels shipped February, 1887, and *used* for bridge in *London*, and duly *paid* for.



Lehigh Valley R. R. Depots and Bridges.

1. Easton, Pa., Station. A. W. Stedman, Chief Engineer. Wilson Bros. & Co., Architects. 2. Athens, Pa., Bridge. A. W. Stedman, Chief Engineer. Thos. H. Rickert, Contractor.
3. Pittston, Pa., Bridge. A. W. Stedman, Chief Engineer. 4. Allentown, Pa., Station. A. W. Stedman, Chief Engineer. Wilson Bros. & Co., Architects.
"Giant" and "Improved Union" Cements used for all work.

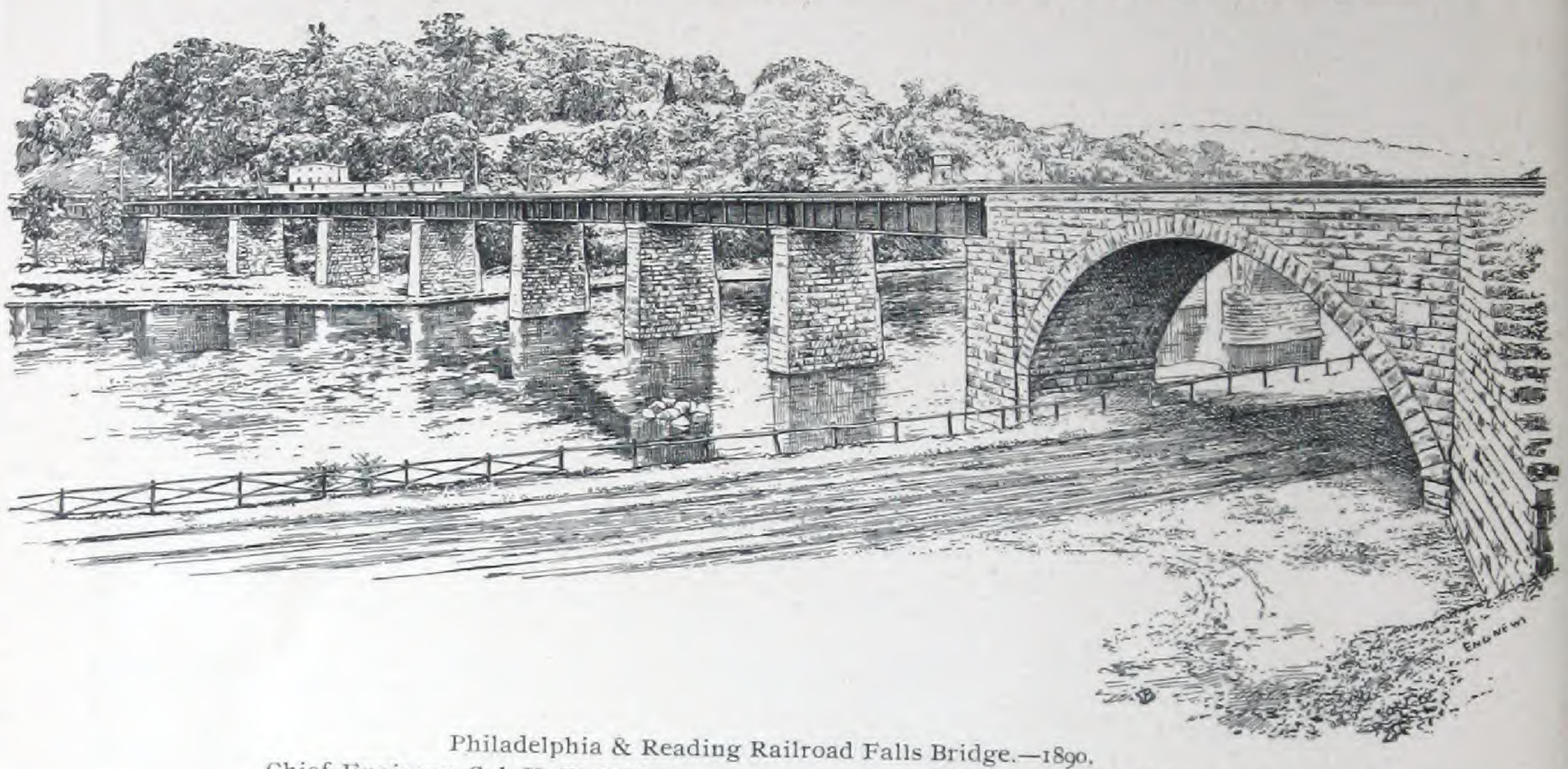
THE PHILADELPHIA & READING RAILROAD COMPANY,
GENERAL OFFICE, 227 S. FOURTH STREET.

PHILADELPHIA, March 4, 1892.

MESSRS. LESLEY & TRINKLE, 220 S. Third Street, Phila.

GENTLEMEN:—Ackowledging your favor of the 3d inst., I beg to say that this company has used quite largely both the "Improved Union" and "Giant" Portland Cements with much satisfaction. The tests, both in the laboratory and on the work, were fully up to our standard.

Yours truly, H. K. NICHOLS, *Chief Engineer.*



Philadelphia & Reading Railroad Falls Bridge.—1890.
Chief Engineer, Col. H. K. Nichols. Contractors, Nolan Bros.
"Giant," "Heyn" Portland and "Improved Union" Cements.

READING TERMINAL, PHILADELPHIA.—JOHN A. WILSON, Chief Engineer.

Tests of "Giant" Portland Cement (25,000 barrels used and still going on), on Philadelphia & Reading Terminal Work, to January 1, 1892:

NEAT.

TIME.	NO BRIQUETTES.	POUNDS AVER.
7 days	159	275
28 "	112	331
2 months	30	384
3 "	24	401
4 "	3	467

1 CEMENT TO 2 SAND.

TIME.	NO BRIQUETTES.	POUNDS AVER.
7 days	2	134

1 CEMENT TO 3 SAND.

TIME.	NO. BRIQUETTES.	POUNDS AVER.
7 days	251	72
28 "	165	117
2 months	40	156
3 "	12	157
4 "	8	164

LEHIGH VALLEY RAILROAD CO.
OFFICE OF CHIEF ENGINEER.

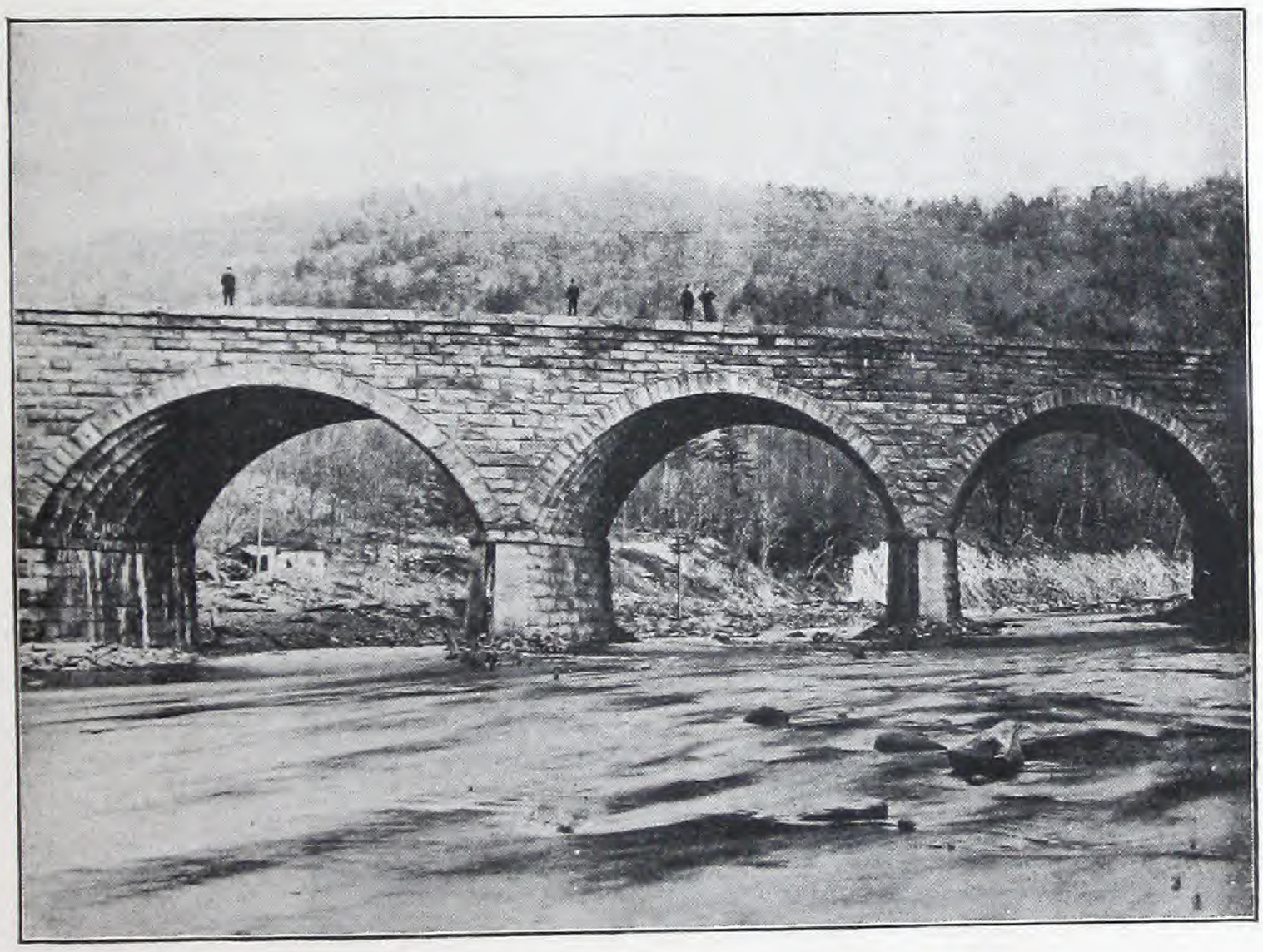
R. W. LESLEY, ESQ.,
Sec'y and Treas. Amer. Improved Cement Co.,
Philadelphia, Pa.

MAUCH CHUNK, PA., October 3, 1888.

DEAR SIR:—I yesterday received your letter of September 29th, 1888, and in reply will say we have used your "Improved Union" Cement on the roads constructed within the last four (4) years and have no fault to find with it. As regards the "Union" Cement I do not know of its use nor of its qualities except as indicated by tests, but I understand it has given satisfaction on our roads wherever used. I am well pleased with the "Improved Union" which I have ordered used on most of our work during the last four (4) years, and know of no case of failure in that time.

Yours truly, (Signed) A. W. STEADMAN, *Chief Engineer.*

Chief Engineer, W. H. Brown. Pennsylvania Railroad—Torresdale Bridge.—1888-89. Contractors, Sparks & Evans.
Exclusively of "Giant" Portland and "Union" Cements. See page 42.



Pennsylvania Railroad Bridge, No. 6—Conemaugh River.
W. H. Brown and J. T. Richards, Engineers. Brown Bros. & Sims, Contractors.
Built in 1890.—"Improved Union" and "Giant" exclusively.

BROWN BROS. & SIMS.
CONTRACTORS, Bullitt Building.

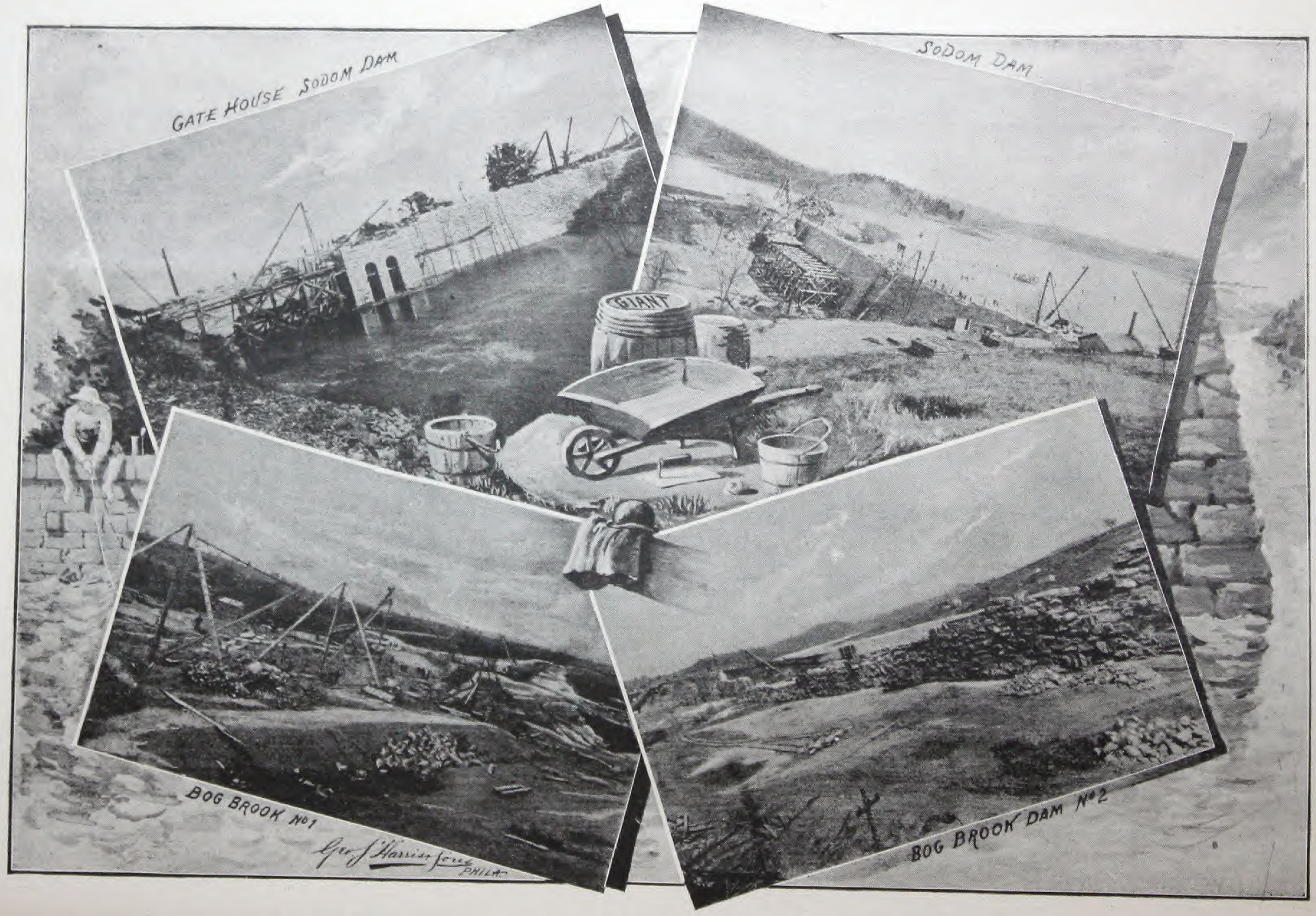
PHILADELPHIA, March 4th, 1892.

AMERICAN IMPROVED CEMENT CO., 220 South Third street.

GENTLEMEN:—We take great pleasure in saying that your "Improved Union" brand of cement (about 10,000 barrels), furnished us in the construction of Bridge No. 6, near Johnstown, on the Pennsylvania Railroad, was entirely satisfactory both to us and to the Pennsylvania Railroad engineers.

Yours truly,

BROWN BROS. & SIMS.



Sodom and Bog Brook Dams Nos. 1 and 2, New York Aqueduct System.—Largest Stone Dams in Eastern States.

A. Fteley, Chief Engineer. C. B. Brush, Division Engineer.

Water Works, Reservoirs, Dams, Etc.

PHILADELPHIA, Reservoirs. RED BANK, N. J., Reservoirs.

GLOUCESTER, N. J., Reservoirs.

MOORESTOWN, N. J., Reservoirs. BELVIDERE, N. J., Reservoirs.

GREENSBURG, PA., Reservoirs.

SCRANTON, PA., Three Dams. PORTLAND, ME., Reservoirs.

SODAM, N. Y., Dam.

HARLEM, N. Y., Aqueduct. BOG BROOK, No. 1, Dam.

CARMEL, Dam.

BOG BROOK, No. 2, Croton Aqueduct System.

CRAFT'S Dam, Croton Aqueduct System.

PURDY'S Dam, Croton Aqueduct System.

DERRY, Pa., Dam. BETHLEHEM, Pa., Reservoir

EAST JERSEY WATER COMPANY, CLINTON, OAK RIDGE,

MACOPIN, Dams.

EDWARD D. ADAMS, President. FRANCIS LYNDE STETSON, First Vice-President. EDWARD A. WICKES, Second Vice-President.

WILLIAM B. RANKINE, Secretary and Treasurer. GEORGE B. BURBANK, Resident Consulting Engineer.

CATARACT CONSTRUCTION CO.

35 Wall Street, New York.

NIAGARA FALLS, N. Y., February 16, 1892.

THE AMERICAN CEMENT CO.

GENTLEMEN:—While I was in charge of the construction of Dams, Connecting Tunnel, &c., which aid in forming Double Reservoir I, of the N. Y. City Water Supply System, about 35,000 barrels of your "Giant" Portland Cement was used, giving entire satisfaction in the work at all times and in all cases.

The tests, covering a period of three years (the results of which I think you have received from my successor, Mr. Walter McCulloh), show that in mortar of either two or three parts sand to one part cement, it is fully equal to the best brands of Imported Portland Cement.

Whenever the results of these tests are compared with others, it should be noted that no "Standard" sand was used by my cement tester, all briquettes were made with sand taken from the pits in use by the contractors.

I have no hesitation in recommending the use of "Giant" Portland Cement for any kind of masonry.

Very respectfully, GEO. B. BURBANK, R. C. E.

Shore Line Thames River Bridge—New London Draw Pier.

A. P. Boller, Engineer. A. McGaw, Contractor.—1888-89.

"Burham," "Giant" and "Union" Cements used. See page 57.

I find Egypt Portland Cement the most desirable brand to handle. It is cheaper than other Portlands, and gives excellent satisfaction. I have sold it to the following firms, who speak highly in its favor:

FARRELL FOUNDRY & MACHINERY CO., Ansonia, Conn.
DERBY RUBBER CO., Birmingham, Conn.
HOUSATONIC WATER CO., Birmingham, Conn.

D. N. CLARK, Shelton, Conn.

TIMOTHY BURKE. JOHN M. BURKE.

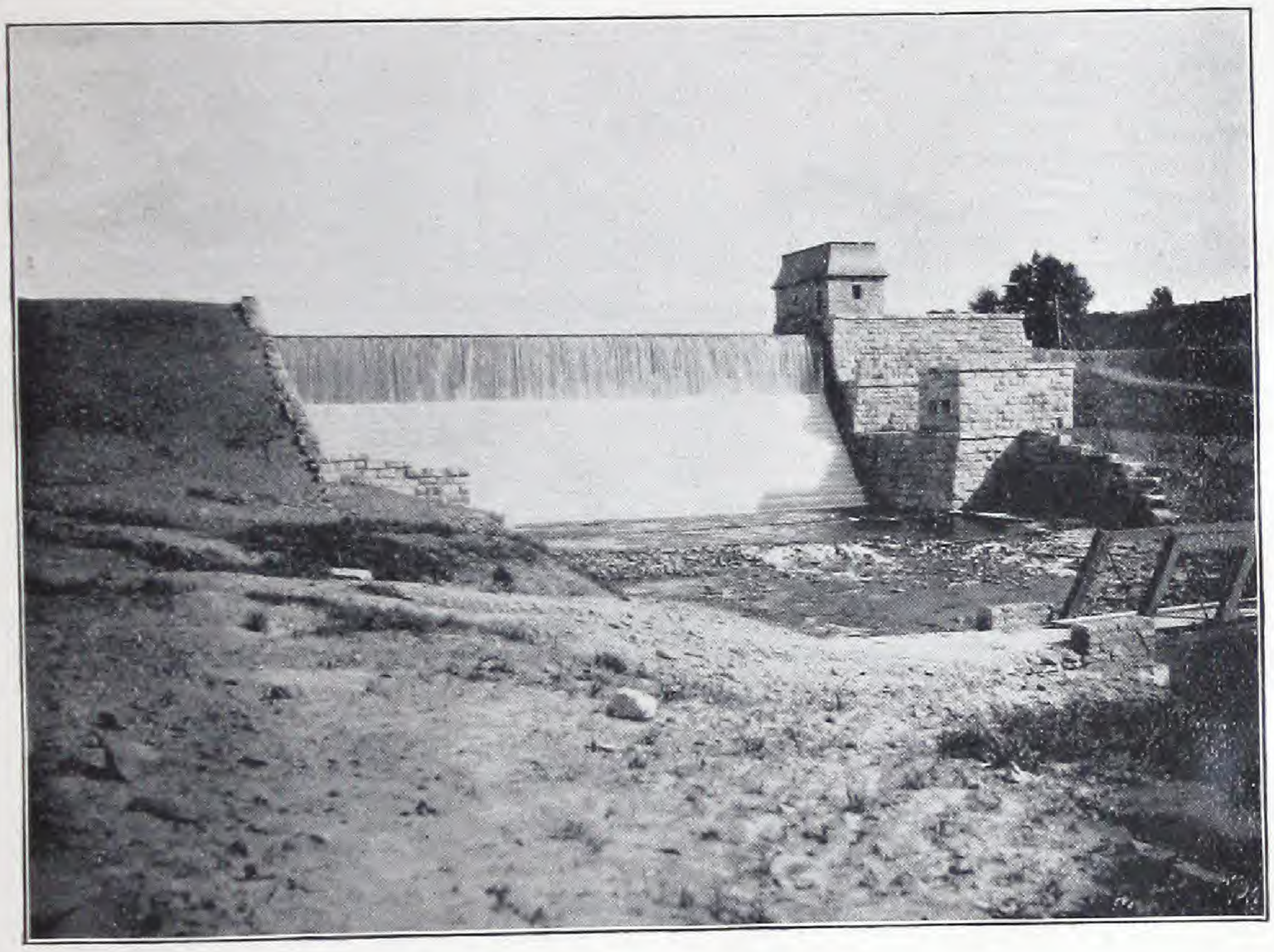
BURKE BROS.,
Contractors.

SCRANTON, PA., February 13, '92.

Messrs. LESLEY & TRINKLE.

GENTLEMEN:—I was not at home when your telegram came. I was sorry, as I wanted to see you. I have a bid on another dam for the Gas and Water Company. I will know about it next week. There are other parties bidding for it. If I am the successful one, I will let you know. I think it will be built with "Improved Union." I have recommended it as the best cement outside of your ("Giant") Portland.

Very truly yours, [Signed] T. BURKE.



Scranton Water Company—Dunning Dam.
E. S. Gould and R. S. Reeves, Engineers. Burke Bros., Contractors.
"Giant" and "Improved Union" practically used exclusively.—1889-1890.

OFFICE OF SCRANTON WATER AND GAS COMPANY.

SCRANTON, PA., January 18, '92

R. W. LESLEY, ESQ.

DEAR SIR:—I noticed a few weeks ago in the *Engineering Record* a short extract you had read before the Engineers' Club, at Philadelphia, on "Purchasing Cement for Large Work," etc., etc. I should like to know something about the tests, etc., of your "Improved Union" on the works of the East Jersey Water Co., if you care to send them.

Your "Improved Union" certainly showed up remarkably well in some masonry. Mr. Burke said here last summer one could hardly tell it from "Portland." My people are talking about building another dam, and, though they think there's nothing fit to use but Portland, I want to find out how it has suited, etc., on this New Jersey job. Any information that you can give me will be appreciated. Very truly, [Signed.] W. M. MARPLE,

Eng. Scranton Gas and Water Co.

WILSON BROTHERS & CO.
CIVIL ENGINEERS AND ARCHITECTS, No. 435 Chestnut Street.

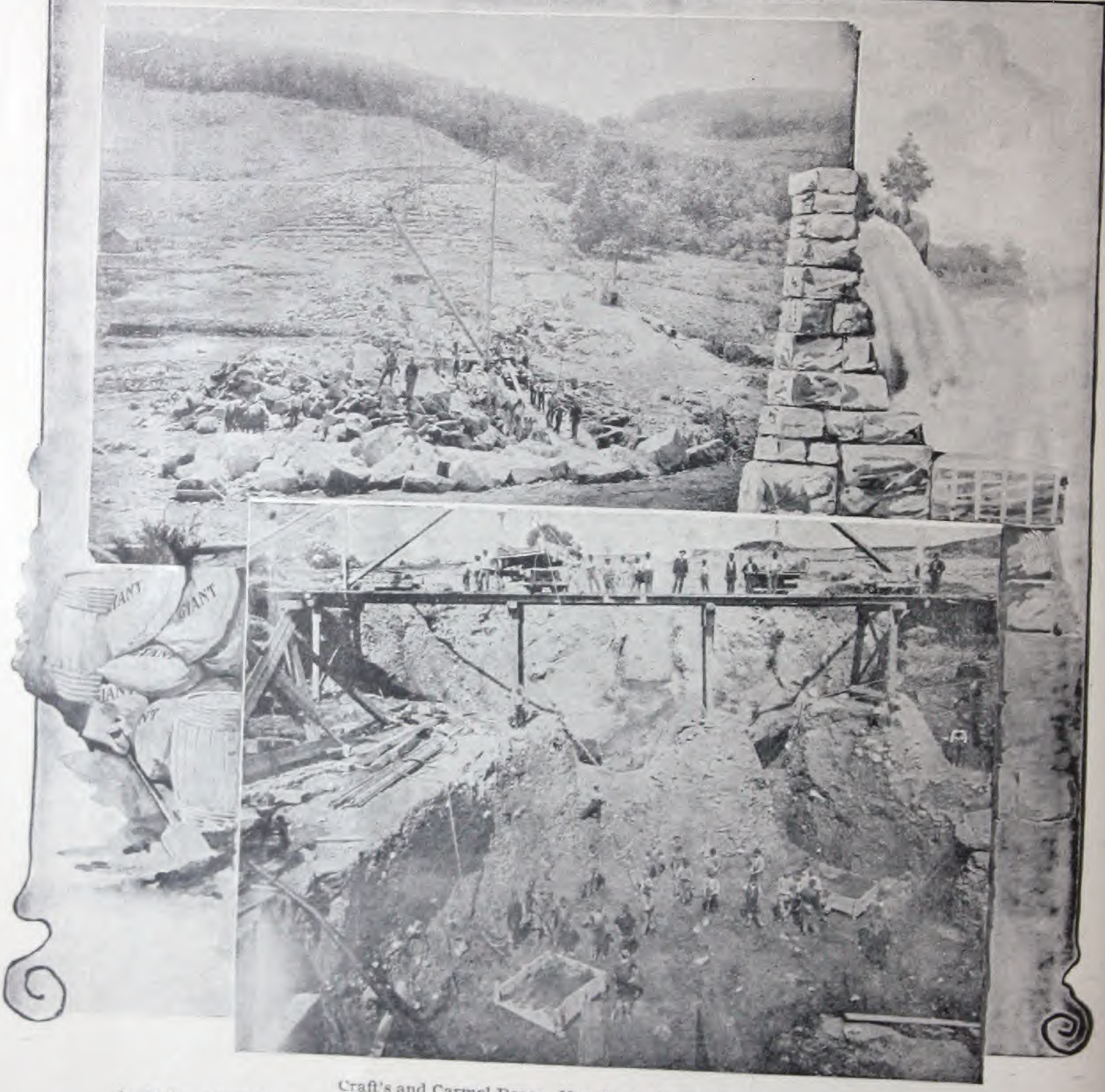
MESSRS. LESLEY & TRINKLE: PHILADELPHIA, PA., March 10, 1887.

GENTLEMEN:—I have used your "Giant" Portland Cement in hydraulic work with excellent results.

At Red Bank, Monmouth Co., N. J., the reservoir was built in excavation and embankment of sand and marl. When the reservoir was in excavation, the material was stratified and, without a water-tight lining, would leak as fast as water could be poured into it.

A concrete bottom was laid, and the slopes lined with stone laid dry, and covered with hard brick work, four inches thick, laid with "Giant" Portland one part, and clean sharp sand two parts, *all joints* grouted full. According to last accounts the reservoir was water-tight.

Respectfully, CHARLES G. DARRACH, C. E.
Of Wilson Bros. & Co.



Craft's and Carmel Dams—New York Aqueduct.
A. Fteley, Chief Engineer.
Alfred Craven, Division Engineer.
Built exclusively of "Giant" Portland Cement.—1891-92.
M. S. Coleman, Contractor.

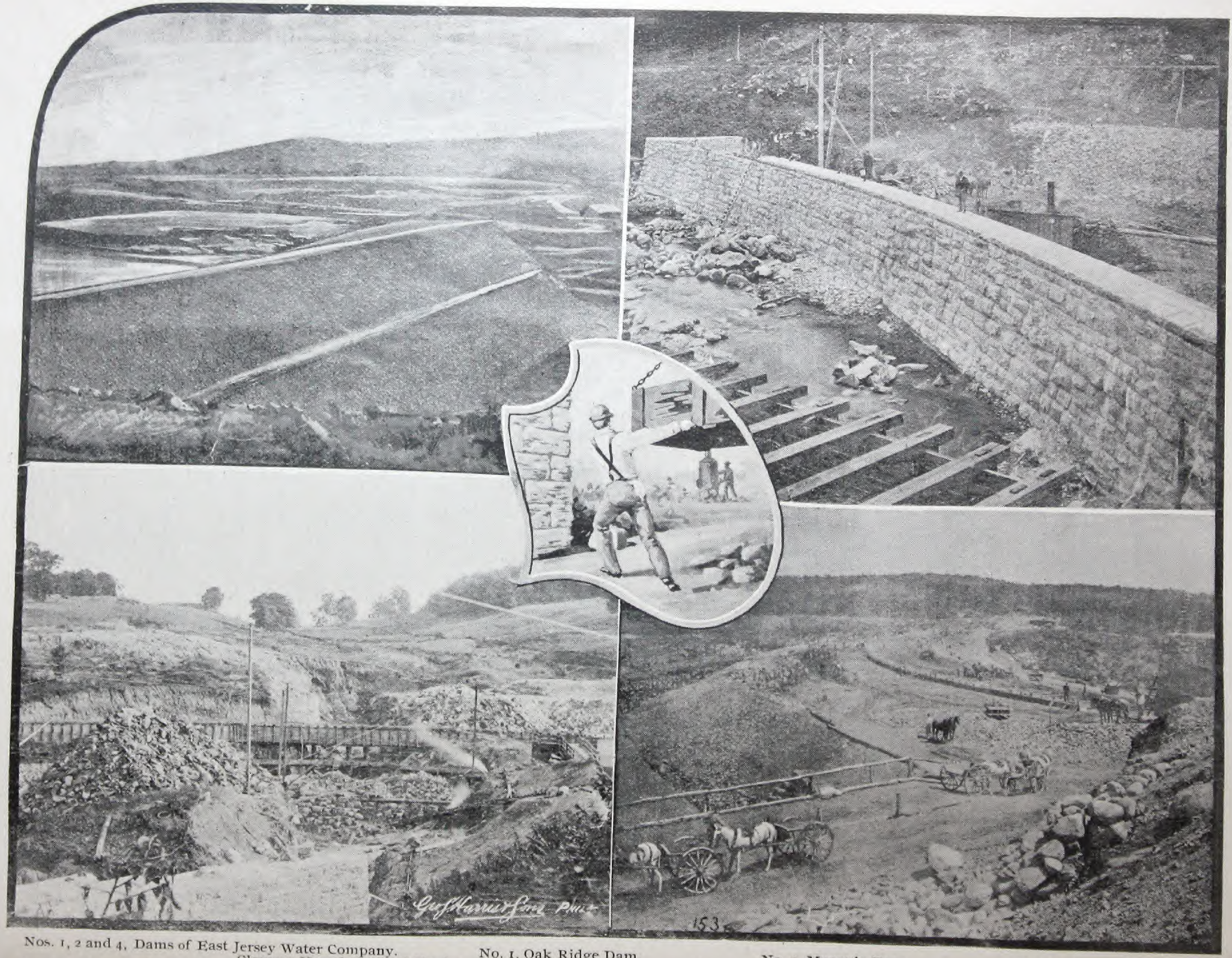
East Jersey Water Company.

Extract from a paper, in *Engineering News*, August 22, 1891, and substantially proceedings Philadelphia Engineers' Club, 1891. No. 16. Submitted, before publication, to Clemens Herschel, Esq.

In the request for bids for the cement for the East Jersey Water Company, the specification sent out stated the amount of cement that would be required, and provided that the cement should be tested for free lime, and that it should weigh so much per cubic foot. All the other elements of the quality of the cement, such as fineness, time of setting, and tensile strength, were left in blank, leaving it to the manufacturer to specify what he was ready to deliver for a given price. The effect of this novel method of purchasing cement was to put the manufacturer in position to be paid for whatever he was ready to do in the way of extra fine grinding and the consequent increased sand carrying qualities of his cement.

As a result of the various bids for the work in question, the contract was awarded to the American Cement Company, for its "Improved Union" Cement, and this cement has been supplied upon the work for two years past. The bid for this season's (1891) work was based upon a guarantee that a mortar of one part "Improved Union" Cement and three parts of sand would give a tensile strength greater than an ordinary Rosendale mortar, of one part cement and two parts sand.

The cement in question, which is practically the standard on Pennsylvania, Reading, Lehigh Valley, and Baltimore and Ohio Railroads, was sold at a price but little higher than the better grades of "Rosendale" Cement, and owes its great strength to the fact that it is an artificial mixture of the natural light burnt cement, of the Lehigh Cement District, and the well-known "Giant" brand, of American Portland Cement, manufactured at the same works, at Egypt, Lehigh County, Pennsylvania. The two to one sand mortar of this grade of cement was guaranteed to stand a tensile strain at seven days of over forty pounds per square inch, while the three to one sand mortar was guaranteed to stand a tensile strain of over twenty-five pounds per square inch also at seven days. For purposes of comparison, it may be stated that the last large Government contract, for the building of the Library of Congress, required of magnesian cements only fifteen pounds, in two to one sand mortars, while of the lime cement it required twenty-five pounds, in two to one sand mortars, at seven days, while the New York Aqueduct specification, for the same grade of cement, required twenty-five pounds for two to one sand mortar. The proportions in the concrete mixture on the East Jersey Water Company's dam of one part cement, three parts sand, and four parts broken stone, as shown by your very interesting article on the subject (*Engineering News*, August 8, 1891, page 113), indicate that the cement has been used almost in the same proportions as a Portland Cement would be used, and the results of the tests made by the East Jersey Water Company's engineers show that the specifications and tests guaranteed by the manufacturers have largely exceeded the guarantee, in twenty-four hours, neat showing, one hundred and thirty pounds, as against seventy pounds guarantee; and at long time tests, that the mortar mixtures and concrete mixtures show a strength almost equal to Portland Cement, and nearly double the strength guaranteed.



Nos. 1, 2 and 4, Dams of East Jersey Water Company. Clemens Herschel, Chief Engineer.

No. 1, Oak Ridge Dam. Over 100,000 bbls. "Improved Union" used.—1890-91. C. S. Gowen, Division Engineer. "Giant" Portland exclusively.

No. 2, Macopin Dam. Washburn, Shaler & Washburn, Contractors.—1891-92.

No. 4, Clinton Dam.

No. 3, Titicus Dam, New York Aqueduct.—A. Fteley, Chief Engineer.

THE EAST JERSEY WATER CO.,
OFFICE OF THE ENGINEER AND SUPERINTENDENT.
Long Distance Telephone—920 Cortlandt (N. Y. City), 415 Paterson (N. J.),
No. 2 Wall Street (N. Y. City).

NEW YORK, August 15, 1891.

R. W. LESLEY, ESQ.,
Treasurer American Cement Co., 220 South Third Street, Phila., Pa.

DEAR SIR:—I return article addressed to the *Engineering News*, with practically no changes. I should have to make a study of our records to say what our results show, other than the facts as stated by you, and that I cannot now do. Yours, very truly,

(Signed) CLEMENS HERSCHEL,
Engineer East Jersey Water Co.

Clipping from an article, in *Engineering News*, February 27, 1892, page 203, Consulting Engineer's report on the new water supply for Newark, N. J., A. Fteley, Consulting Engineer.

Construction of the Dams.

The two storage dams are built on a common plan. They are formed of a heavy earth embankment, containing in its centre a wall made of concrete. An ample spill-way and a gate chamber for the distribution of the water are also built in connection with each.

The foundation of the centre wall has been, with two exceptions, extended to the solid rock, reaching at places considerable depth. The centre wall is of sufficient thickness, and is made of concrete, of good quality. The earth on each side of the wall has been laid in thin layers, well-compacted, and the embankments are protected by stone riprap. The dams proper are, on the whole, substantially built and the execution of the work has apparently been of a satisfactory character.

Gas Works Construction.

W. C. WHYTE, ENGINEER AND CONTRACTOR, 15 Cortland Street.

NEW YORK, Feb. 21, 1889.

C. M. HARRIS, ESQ.,
Agent for Lesley & Trinkle:

DEAR SIR:—In reply to your inquiry as to the value of your American Portland Cement, I would say that I have used thousands of barrels of it, and I consider it superior for gas tank work, concreting especially to any foreign cement I have ever tried. I believe this to be due to the great care in manufacture, and less liability to damage through sea voyage.

When able to procure your cement I have always adopted it, finding it as I say better for my business than the foreign brands of Portland. Yours truly,

(Signed) W. C. WHYTE.

PITTSBURGH, PA., January 29, 1889.

PENNA. MFG., MINING AND SUPPLY CO.:

GENTLEMEN:—Having used your Improved Rosendale Cement in large quantities during the year 1888, both in concrete and masonry work, I believe it to be equal in every respect to the best brands of Rosendale. Your "Giant" Portland I regard as equal to the best brands of imported.

Truly yours,

F. GWINNER, PER JR.

OFFICE OF
JOSEPH FLANNERY,
ENGINEER, GAS AND WATER WORKS, No. 216 S. Third Street.

PHILADELPHIA, December 15, 1886.

AMERICAN IMPROVED CEMENT CO.:

DEAR SIRS:—During the past three years some ten thousand barrels of "Union" Cement and two thousand barrels of "Giant" Portland Cement, manufactured by you, were used under my direction as engineer in the construction of the gas tanks of the Bay State Gas Company, of Boston; Consumers' Gas Company, of Jersey City, N. J., and the Richmond County Cas Company, of New Brighton, Staten Island; and I am pleased to be able to state that the cement has given complete satisfaction. The tanks were, in every case, in marshy ground where the cement was exposed to the severest tests. Especially, was this the case in Boston, were two large tanks, 152 feet in diameter and 30 feet deep, were built in the marshes in the outer harbor; and, when after the completion of the work, the tanks were filled with water, were found to be absolutely water tight. I consider your cement especially adapted to gas works' construction, where great strength and hydraulic qualities are required. The "Union" is superior to any Rosendale I have ever used, and the "Giant" Portland fully equal to any of the foreign brands.

Very truly,

JOSEPH FLANNERY.

OFFICE OF
OMAHA GAS MANUFACTURING CO.

OMAHA, NEB., February 15, 1886.

GENTS:—Will you kindly send me one of your pamphlets. Several hundred barrels "Giant" and Improved "Union" have been used under my direction here, in building the new gas holder, and I can speak very highly of the brands. JOSEPH E. NUTE, S. B.

W. W. GIBBS, PRESIDENT. A. C. HUMPHREYS, SUPERINTENDENT

OFFICE OF
UNITED GAS IMPROVEMENT CO.
333 WALNUT STREET,

PHILADELPHIA, October 2, 1888

DEAR SIR:—Messrs. Lesley & Trinkle have asked me to express my opinion of their cement.

We have for some 3 or 4 years been using their cements. We have used them in building our gas holder tanks, which you know is nice work. The tank, to be efficient, must be absolutely water-tight. The cement has served its purpose well, and it seems to have the advantage of growing steadily harder under water.

Truly yours,

ALEX. C. HUMPHREYS,
General Superintendent.

BEACON CONSTRUCTION CO.

BOSTON, MASS., July 8, 1886.

AMERICAN IMPROVED CEMENT CO.:

DEAR SIRS:—Your favor of 7th at hand. I am very sorry about the matter as we preferred to use your "Giant" Cement. Kindly now send quotations and time of delivery, and oblige

(Signed) J. EDWARD ADDICKS,
Chairman.

Shore Line Thames River Bridge, New London.
A. P. Boller, Engineer. A. McGaw, Contractor, 1889.
"Giant" "Burham" and "Union" Cements.

ALFRED P. BOLLER, C. E. BOLLER & McGAW, ALEXANDER McGAW.
CIVIL ENGINEERS AND CONTRACTORS,
71 Broadway, N. Y., and 410 Walnut Street, Phila, Pa.

NEW YORK, January 15, 1887.

AMERICAN IMPROVED CEMENT CO.,
216 S. Third Street, Philadelphia:

GENTLEMEN:—We beg to say that we have largely used your cements in bridges, foundations and gas tank work, and with entire satisfaction. Our most recent large work has been the gas tanks for the Beacon Construction, Boston, which were sunk in the marsh near the new sewerage pumping station. These tanks (2) were each 152 feet inside diameter, by 30 feet deep; were built of brick and your "Union" Brand Cement, the bottoms being a concrete, made mostly with a matrix of your Portland "Giant" Cement. When completed, the tanks were phenomenally tight, having pratically no leakage whatever. We have no hesitation in saying that your cements are equal to the best that we have ever used.

Respectfully and truly,
BOLLER & McGAW.

Manufacturing Establishments.

THOMAS IRON COMPANY. CRANE IRON COMPANY.

THE PENNOCK IRON WORKS.

WHARTON SWITCH WORKS. HARRISBURG ROLLING MILLS.

NORTH BRANCH STEEL COMPANY, 10,000 BARRELS.

HARRISBURG MARKETS. WILCOX PAPER MILLS.

HOMESTEAD STEEL WORKS.

CARNEGIE BROTHERS & COMPANY. MIDVALE STEEL COMPANY.

W. D. WOOD & CO., McKeesport.

PENNA. R. R. ABATTOIR, Phila. PHILA. MARKET COMPANY, Phila.

PENCOYD IRON WORKS.

DOBSON'S MILLS. WM. CRAMP & SONS, SHIPYARD.

BALDWIN'S LOCOMOTIVE WORKS.

WILLIAM SELLERS & COMPANY. CARNEGIE, PHIPPS & COMPANY.

HARRISBURG ROLLING MILLS.

MAHONING ROLLING MILLS. J. A. ROEBLING & SONS.

HOSTETTER COKE WORKS. H. C. FRICK & COMPANY.

STARK BROTHERS,

GENERAL CONTRACTORS AND BUILDERS.

GREENSBURG, PA., February 7, 1889.

PENNSYLVANIA MFG., MINING AND SUPPLY CO., PITTSBURGH, PA.,
Agents American Cement Co.:

GENTLEMEN:—We desire to say that we have used a very large amount of your Cement during the past year, and can say that every barrel has given entire satisfaction. This cement was used at the Chambers & McKee new Glass Works, at Jeannette, Pa., and also at Mt. Pleasant Reservoir, Mt. Pleasant, Pa.

Yours, very respectfully,

STARK BROTHERS.

OFFICE OF DIXON, WOODS & CO.,

GLASS HOUSE FURNACES.

PITTSBURGH, PA., January 31, 1889.

PENNSYLVANIA MFG., MINING AND SUPPLY CO.,
Agents American Cement Co.:

GENTLEMEN:—We have used your Improved "Rosendale" Cement very extensively in the construction of the furnaces of the Chambers & McKee Glass Co., at Jeannette, Pa., and other work, and are pleased to express our entire satisfaction with it, and to testify to its superior quality. It is equal to, and, in our opinion, superior to any in the market. We will have use for more, and will certainly give you our orders.

Yours truly,

DIXON, WOODS & CO.

J. M. WILCOX & CO.,

OFFICE, 509 MINOR STREET.

PHILADELPHIA, April 7, 1887.

AMERICAN CEMENT CO.:

DEAR SIRS:—We have given your Portland Cement a very severe trial, and it has proven satisfactory. We built foundations, when making repairs at Glen Mills, which have been either under water or exposed to dampness ever since.

We built our drains and acid tanks of brick, laid with this same cement, and as you know, the walls of the drainers are subjected to very heavy pressure, yet are still firm. The acid tank we laid with brick, one row on edge, and then gave it a slight dashing of cement, pure. We had occasion to enlarge this tank a few days ago, but in order to get the brick out we had to break them, as the cement would not give, seeming to have become part of the brick. The brick in that case had been in position a little over 3 years, and the tank was always filled with solution of chloride of lime.

Yours truly,

J. M. WILCOX & CO.

Large Buildings.

DREXEL BUILDING, PHILA., Wilson Bros. & Co., *Architects.*

NEW COUNTY PRISON, Three Years.

THE NEW HOUSE OF REFUGE.

THE NEW WILLIAMSON SCHOOL.

THE COLD STORAGE CO.

THE WEST PHILA. ABATTOIR.

PROVIDENT TRUST BUILDING.

THE BRYN MAWR HOTEL.

GIRARD LIFE AND TRUST BUILDING.

THE KEYSTONE BANK.

And in fact nearly all of the large buildings in and about Philadelphia.

NEW CRIMINAL COURT, N. Y.

NEW CITY HALL, PITTSBURGH.

Extract from the "Philadelphia Times,"

NOVEMBER 4, 1888.

"As the Drexel Building was to be rapidly constructed, the architects ordered that, instead of old-fashioned lime mortar, Portland Cement should be used, and after sturdy competition, the AMERICAN IMPROVED CEMENT COMPANY'S "Giant" Portland Cement was selected, and the contract given to the Philadelphia Agents, Messrs. Lesley & Trinkle, No. 220 South Third Street. They

Drexel Building, Philadelphia.
Cost nearly $4,000,000. Over 12,000 Barrels "Giant."—1887-88.
Architect, Wilson Bros. & Co. Contractor, Stacy, Reeves & Son.

furnished 12,000 barrels of the "Giant" Portland Cement, and 2,000 barrels of the "Union" Cement, both of which were pronounced by the builders as superior to anything imported. This is a new manufacture in this country, most of the cements coming from Germany and England.

"The successful use of "Giant" Portland Cement in such important works as the Drexel Building, the New York Aqueduct, the Philadelphia and Pittsburgh Cable Roads, the Newark, N. J., Drainage System, and the Scranton Water Company, has made it the standard for Portland Cement in this country."

JOHN A. WILSON, Civil Engineer. JOS. M. WILSON, Civil Engineer and Architect. CHAS. G. DARRACH, Civil and Hydraulic Engineer.

WILSON BROS. & CO.
CIVIL ENGINEERS AND ARCHITECTS,
No. 435 Chestnut Street.

PHILADELPHIA, May 26, 1888.

ROBERT W. LESLEY, ESQ.,
216 S. Third Street:

MY DEAR SIR:—Enclosed I send a little memento which may be interesting to you. The cement shown on the specimen attached to a small piece of brick, was some of that supplied by you at the Drexel Building. A test pier was built in freezing weather last December. The proportion of the mixture was one part cement and two parts sand. The bricks were well wetted, and the pier allowed to remain on top of Mr. Drexel's bank through the weather until yesterday, May 25th, when the pier was broken and the adhesion of the cement to the brick was so great that the brick was broken rather than the joint between it and the cement, as you will see by the specimen enclosed. Thinking you would like to have this specimen, I am,

Yours very truly, CHAS. G. DARRACH.

The "Waldorf"—The New Astor Hotel, New York.
Henry J. Hardenburg, Architect. R. L. Darragh, Contractor.—1891.
6000 bbls. "Giant" used.

NEW YORK.

UNITED BUILDING MATERIAL CO.:

GENTLEMEN:—I have used some of your "Giant" Portland Cement to build the foundation work of the Waldorf Astor Hotel, during the past summer, and I found it to be a good, reliable Portland Cement.

Yours, R. L. DARRAGH.

OFFICE OF FURNESS, EVANS & COMPANY,
ARCHITECTS.

MESSRS. LESLEY & TRINKLE,
220 South Third Street, Philadelphia, Penna.

PHILADELPHIA, February 19, 1892.

DEAR SIRS:—We have within the last seven (7) years, used large quantities of your "Giant" Portland Cement, on most all of the important work done by us.

Among the buildings constructed with this cement and in which it has given entire satisfaction, are the Williamson School, the Bryn Mawr Hotel, the Library Building of the University of Pennsylvania and the building of the Provident Insurance and Trust Co. in this city.

It is a gratification to us to know by practical experience, that as good Portland Cement can be made in this country as any imported. Very truly yours,

FURNESS, EVANS & CO., *Architects.*

Furness, Evans & Co., Architects. Geo. W. Roydhouse, Contractor.—1890.
"Giant" and "Hilton" Portland used in foundation and masonry.

WATERBURY, CONN., October 15, 1891.

TO UNITED BUILDING MATERIAL CO.:

DEAR SIRS:—We have used the Egypt "Giant" and are well satisfied with it. We have on hand a small quantity which will last through the winter, unless some contract requires Portland Cement. We then would order Egypt.

Yours respectfully,

CHATFIELD & CHATFIELD.

Girard Estate Building, Philadelphia.

Architect, J. H. Windrim. Contractor, A. B. Rorke.

"Giant" and "Hilton" Portland Cement.

NORWALK, CONN., October 27, 1891.

UNITED BUILDING MATERIAL CO.:

GENTLEMEN:—We are using your "Egypt" Portland Cement in the manufacture of our pipe, and also sell same to our trade; and can say that it has always proved a very satisfactory cement to handle.

Yours,

CHAS. T. LEONARD.

FRANK G. WOOD,

Successor to FRANKLIN GERARD.

DEALER IN MASONS' BUILDING MATERIALS,

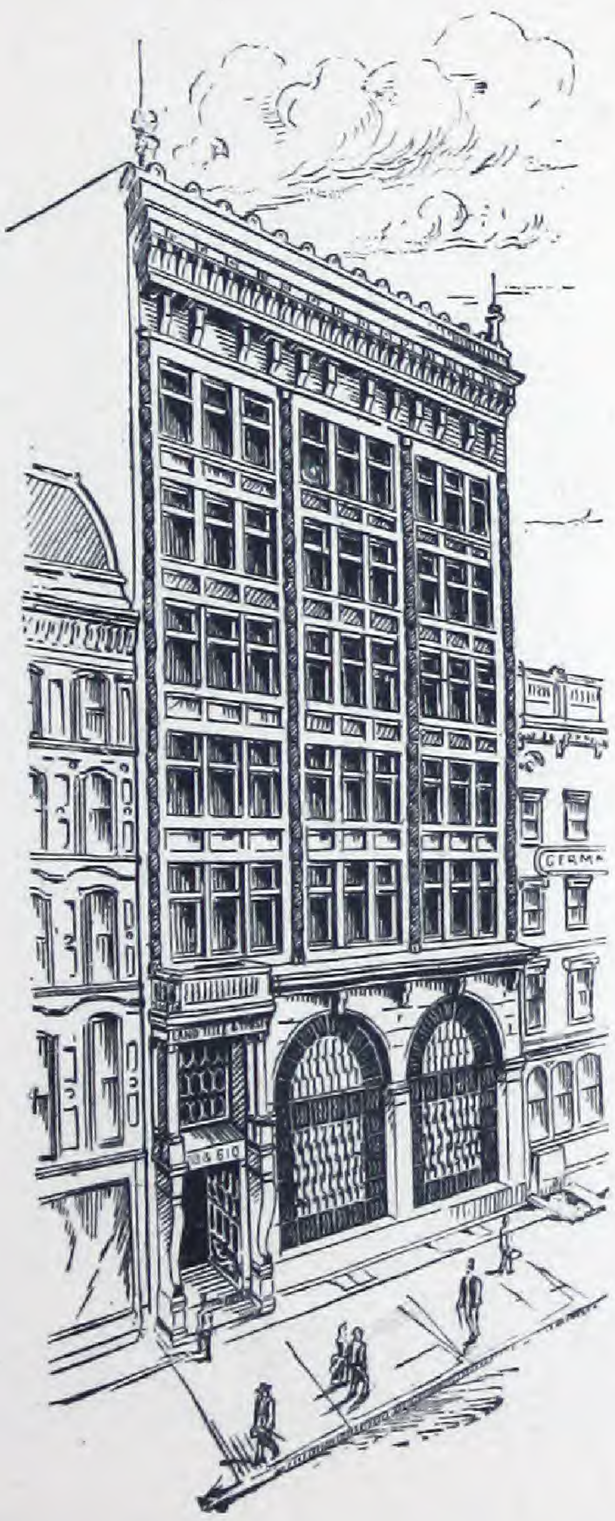
No. 134 Washington Street.

NEWBURGH, N. Y., July 17, 1891.

C. M. HARRIS, ESQ.:

DEAR SIR:—I have used your "Egypt" Portland Cement with my general trade, and have recently supplied a considerable quantity for the construction of a reservoir dam near this city. I am pleased to say that in all cases it has given the best of satisfaction to masons, engineers, etc., using same.

FRANK G. WOOD.



Land, Title and Trust Co.'s Building, Philada.—1890.

Engineers and Architects, Wilson Bros. & Co. See page 62.

DANVILLE, PA.

NORTH BRANCH STEEL CO.

Used twenty thousand barrels "Giant" with "entire satisfaction."

OFFICE OF
RAYMOND BROTHERS,
137 Washington Street.

SOUTH NORWALK, CONN., October 27, 1891.

UNITED BUILDING MATERIAL CO.:

GENTLEMEN:—In regard to the "Egypt" Portland Cement, which we purchased from you for our trade, we are pleased to say that it gives good satisfaction, and we find it a paying article to keep in stock.

Yours,

RAYMOND BROTHERS.

Hood, Bonbright & Co.'s Building, Philadelphia.

Architect, J. H. Windrim. Contractor, A. B. Rorke.

"Giant" and "Hilton" Portland Cements.

SETH L. PECK,

MASONS' BUILDING MATERIALS,

Wholesale and Retail.

NORWICH, CONN., Oct. 28, 1891.

UNITED BUILDING MATERIAL CO.:

GENTLEMEN:—I have been using your "Egypt" Portland in our trade and find it gives entire satisfaction. It was used in the stone piers for the Union Station here and gave most excellent results.

Yours truly,

SETH L. PECK.

Girard Trust Co.'s Building, Philadelphia.—1890.

A. Hutton, Architect. Pennock Bros., Contractors.

"Giant" Portland used in foundations.

THE PHILADELPHIA BRIDGE WORKS,
COFRODE & SAYLOR (Incorporated),
Office, 257 South Fourth Street.

PHILADELPHIA, March 5th, 1892.

AMERICAN CEMENT CO., 220 South Third Street.

GENTLEMEN:—In the construction of the building known as the Central Stores, (see page 10) located at Twenty-ninth street and Eleventh avenue, New York City, the dimensions of which are about 700 feet by 200 feet, we used in the neighborhood of thirty thousand barrels of your "Improved Union" and "Giant" Cements. We have never had any trouble with your cements; they are of excellent quality and we would highly commend to all parties desiring to use same.

Respectfully,

(Signed) COFRODE & SAYLOR, (Incorporated)

By P. R. Foley, *Treasurer.*

City Trust Co., Philadelphia.

W. Eyre, Jr., Architect.—1889. "Giant" Portland and "Union" Cement.

Abstract

OF UNIFORM SYSTEM OF TESTS OF CEMENT RECOMMENDED BY THE COMMITTEE OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS, JUNE 21ST, 1885.

Fineness.

The strength of a cement depends greatly upon the fineness to which it is ground, especially when mixed with a large dose of sand. It is, therefore, recommended that the tests be made with cement that has passed through a No. 100 sieve (10,000 meshes to the square inch), made of No. 40 wire, Stubb's wire gauge. The results thus obtained will indicate the grade which the cement can attain, under the condition that it is finely ground; but it does not show whether or not a given cement offered for sale shall be accepted and used. The determination of this question requires that the tests should also be applied to the cement as found in the market. Its quality may be so high that it will stand the tests even if very coarse and granular, and on the other hand it may be so low that no amount of pulverization can redeem it. In other words, fineness is no sure indication of the value of a cement, although all cements are improved by fine grinding. Cement of the better grades is now usually ground so fine that only from 5 to 10 per cent. is rejected by a sieve of 2500 meshes per square inch, and it has been made so fine that only from 3 to 10 per cent. is rejected by a sieve of 32,000 meshes per square inch. The finer the cement, if otherwise good, the larger dose of sand it will take, and the greater its value.

Checking or Cracking.

The test for checking or cracking is an important one, and though simple, should never be omitted. It is as follows: Make two cakes of neat cement 2 or 3 inches in diameter, about one-half inch thick, with thin edges. Note the time in minutes that these cakes, when mixed with mortar to the consistency of a stiff plastic mortar, take to set hard enough to stand the wire test recommended by General Gillmore, one-twelfth inch diameter wire loaded with one-quarter of a pound and one-twenty-fourth of an inch diameter wire, loaded with one pound. One of these cakes, when hard enough, should be put in water and examined from day to day to see if it becomes contorted or if cracks show themselves at the edges, such contortions or cracks indicating that the cement is unfit for use at that time. In some cases the tendency to crack, if caused by the presence of too much unslaked lime, will disappear with age. The remaining cake should be kept in the air and its color observed, which for a good cement should be uniform throughout, yellowish blotches indicating a poor quality; the Portland Cements

being of a bluish-grey color, and the natural* cements being light or dark according to the character of the rock of which they are made. The color of the cements when left in the air indicates the quality much better than when they are put in water.

Tests Recommended.

It is recommended that tests for hydraulic cement be confined to methods for determining fineness, liability to checking or cracking, and tensile strength; and for the latter, for tests of 7 days and upward, that a mixture of 1 part of cement to 1 part of sand for natural cements, and 3 parts of sand for Portland Cements, be used, in addition to trials of the neat cement. The quantities used in the mixture should be determined by weight.

The tests should be applied to the cements as offered for sale. If satisfactory results are obtained with a full dose of sand, the trials need go no further. If not, the coarser particles should first be excluded by using a No. 100 sieve (10,000 meshes to the square inch), in order to determine approximately the grade the cement would take if ground fine, for fineness is always attainable, while inherent merit may not be.

Mixing, Etc.

The proportions of cement, sand and water should be carefully determined by weight, the sand and cement mixed dry, and all the water added at once. The mixing must be rapid and thorough, and the mortar, which should be stiff and plastic, should be firmly pressed into the moulds with the trowel, without ramming, and struck off level; the moulds in each instance, while being charged and manipulated, to be laid directly on glass, slate or some other non-absorbent material. The moulding must be completed before incipient setting begins. As soon as the briquettes are hard enough to bear it, they should be taken from the moulds and be kept covered with a damp cloth until they are immersed. For the sake of uniformity, the briquettes, both of neat cement and those containing sand, should be immersed in water at the end of twenty-four hours, except in the case of one day tests. Ordinary fresh clean water having a temperature between 60 and 70 degrees F. should be used for the water of mixture and immersion of samples.

The proportion of water required varies with the fineness, age or other conditions of the cement and the temperature of the air, but is approximately as follows:

For briquettes of neat cement: Portland about 25 per cent.

Natural cement, about 30 per cent.

For briquettes of 1 part cement and 1 part sand, about 15 per cent. of total weight of sand and cement.

* Where the word "Natural" is used in this paper, it is to be understood as being applied to the lightly burned American or foreign cements, in contradistinction to the more heavily burned Portland Cements, either natural or artificial.

For briquettes of 1 part cement, 3 parts sand, about 12 per cent. of total weight of sand and cement.

The object is to produce the plasticity of rather stiff plasterer's mortar.

An average of five briquettes may be made for each test, only those breaking at the smallest section to be taken. The briquettes should always be put in the testing machine and broken immediately after being taken out of the water, and the temperature of the briquettes and of the testing room should be constant between 60 and 70 degrees F.

[NOTE.—Your committee thinks it useful to insert here a table showing the average minimum and maximum tensile strength per square inch which some good cements have attained when tested under the conditions specified elsewhere in this report. Within the limits given in the following table, the value of a cement varies closely with the tensile strength when tested with the full dose of sand.]

American natural cement, neat :

1 day, 1 hour or until set, in air, the rest of the 24 hours in water, from 40 to 80 pounds. 1 week, 1 day in air, 6 days in water, from 60 to 100 pounds.
1 month (28 days), 1 day in air, 27 days in water, from 100 to 150 pounds.
1 year, 1 day in air, the remainder in water, from 300 to 400 pounds.

American and foreign Portland Cements, neat :

1 day, 1 hour or until set, in air, the rest of the 24 hours in water, from 100 to 140 pounds.
1 week, 1 day in air, 6 days in water, from 250 to 550 pounds.
1 month,(28 days), 1 day in air, 27 days in water, from 350 to 700 pounds.
1 year, 1 day in air, the remainder in water, from 450 to 800 pounds.

American natural cement, 1 part cement to 1 part sand :

1 week, 1 day in air, 6 days in water, from 30 to 50 pounds.
1 month, (28 days), 1 day in air, 27 days in water, from 50 to 80 pounds.
1 year, 1 day in air, the remainder in water, from 200 to 300 pounds.

American and foreign Portland Cements, 1 part of cement to 3 parts of sand :

1 week, 1 day in air, 6 days in water, from 80 to 125 pounds.
: month, (28 days), 1 day in air, 27 days in water, from 100 to 200 pounds.
1 year, 1 day in air, the remainder in water, from 200 to 350 pounds.

Notes on Cement and Its Use.

Below will be found a few paragraphs on Cements, taken from such authorities on the subject as Laxtan, Grant, Vicat, Drake, Reid, Gilmore, De Smedt, Michaelis, and Maclay. As they embrace a number of important points concerning the use and abuse of Cement, they may be of interest to the reader:

Well-burned, heavy, fine ground cements are the best.

Cement work should not be tampered with after setting has begun.

Neat cement reaches its full strength in a much shorter time than a mixture of sand and cement, but tests show that the concrete mixtures gradually gain upon the neat cement, and ultimately reach and even surpass it in strength.

Good Portland Cement continues to harden and attain a greater tensile strain for a long period, in some cases for three years. A mixture of one part sand to one part cement, tested in London, showed an increase of from 353 to 836 pounds on a 2¼-inch section at the end of seven years.

When bricks are laid in cement, they should first be well-wetted, as otherwise they absorb the water from the cement mortar.

Badly burnt, light weight cement is to be avoided.

Salt water does not injure cement.

Clean water and sharp sand should be used with cement; the cleaner and sharper the sand, the better the mortar.

Portland cements differ from natural cements in that, if kept away from dampness, they improve, instead of deteriorating, with age.

At the end of a year, a mortar of one part sand to one part cement has two-thirds the strength of neat cement; two of sand to one of cement, over one-half the strength of neat; three of sand to one of cement, nearly one-half the strength of neat; four of sand to one of cement, about one-fourth the strength of neat.

Loamy sand is a great enemy to good cement.

Cement and lime should not be used together in the same mortar, as one sets by the formation of hydro-silicate and the other by the formation of carbonate of lime. Their setting being different, the effect of mixing them is the ruin of the mortar.

Good cement may be drowned by an excess of water. The less water, the better mortar.

In hot weather, cement work should not be allowed to dry too quickly. It should be sprinkled with water to protect it from the summer sun.

In masonry, the stone should be moistened before putting on the cement, as otherwise the water is absorbed from the mortar and setting is prevented.

The advantage of a moderately slow setting over a quick setting cement is that the former can be mixed up in larger quantities and used without retempering, whereas the latter sets before it can be used on the work, and when remixed or retempered, loses some of its strength.

Portland Cement is grey in color and crystalline in texture, the result of the high temperature at which it is burned, and the nearer a natural hydraulic cement approaches it in color and texture, the greater its strength.

The sand and cement should be well-mixed together, dry, before water is added, and the latter should be added little by little to the mixture.

Better and more uniform results are obtained with briquettes having a breaking section of 1 by 1 inch than with briquettes, with a breaking section of 2¼ square inches.

In testing cements, the briquettes should be broken directly from the water, as an absence of water causes a cessation of the setting by the hydration of silicates in a true cement; but may cause, in improperly manufactured cement, containing inert or clayey matter, an artificial strength produced by cohesion, which, in time, is lost.

At the Chicago fire artificial stone made of Portland Cement proved itself to be the one fire-proof building material.

Where cement is to be used in sea water it should, on account of the difference in the composition of sea water, be first tested in the water in which it is to be used.

Finely ground cement, when mixed neat, does not give as good results as one more coarsely ground; but when mixed with sand the fine ground cement will surpass the more coarsely ground.

Concrete should be made as required. If setting begins before it is put in place the concrete is worthless.

The smooth, clayey mortars made by the Rosendale and other similar cements are due to an excess of clayey matter in the cement, as evidenced by their want of strength when compared with the gray, crystalline, gritty mortars made with the Portland, or the natural cements of that character.

Economy in use is proportionate to the adhesive strength of all cements, and this relative strength should always gauge the relative proportion of sand that may be properly used to accomplish a given purpose.

The setting of cement being a chemical operation, the finer ground the cement the more active particles, and, therefore, the quicker the setting, when the hydration by the adding of water goes on.

The quickness or slowness of the setting of cement is governed by the question of the temperature of the cement, the air and water. The nearer these

approach to a common temperature, the quicker the setting ; thus, in hot weather, cements set quickly, while in cold weather, where a material difference exists in the temperature of the cement, water and air, the setting is more slow.

Cements which set quickly neat are not necessarily quick-setting when mixed with sand. By the addition of two or three more parts of sand, the setting of the quick-setting cement is quickly retarded to enable it to be safely used in all work.

By a series of tests covering a period of eight years, English engineers have ascertained that cement giving tensile strain neat between 300 and 350 pounds per square inch at 7 days, shows the highest ultimate results and the highest percentage of increase per annum ; while cements showing strains of 500 and 600 pounds per square inch at 7 days, show no ultimate gain, but an actual loss, and a very slight percentage of annual gain.

Concrete.

In making concrete by hand the sand should be first spread out, and then the amount of cement decided upon should be added. These two ingredients are then to be mixed together dry, and then the requisite amount of water is to be added. The concrete stone, which has been moistened, is then to be thrown into the bed, and the whole amount thoroughly mixed together three or four times, when the concrete is ready for use.

It should be remembered that even with the same amount of water necessary to make a mortar of the given stiffness, the mortar varies with the temperature and degree of moisture of the air, and the dryness of the sand. It great strength is required, only enough water should be used to make the mortar resemble damp earth, and this, when properly rammed in thin layers, will show a little moisture on its surface.

Measures and Figures.

FROM LAXTAN'S BUILDERS' GUIDE AND OTHER AUTHORITIES

1 barrel Portland Cement=4 bushels (nominally).
1 barrel Natural Cement=4 bushels (nominally).
1 barrel Portland Cement weighs 380 lbs., net.
1 barrel Natural Cement weighs 300 lbs., net.
1 barrel Portland Cement contains about 4 cubic feet.
1 barrel Natural Cement contains about 4 cubic feet.

	Thickness.		
	1 inch.	¾ inch.	½ inch.
	yards.	yards.	yards.
1 bushel Portland Cement will cover.....	1 ¼	1½	2¼
1 " " " and 1 of sand will cover....	2¼	3	4½
1 " " " " 2 " "	3½	4½	6¾

Concrete.

1 barrel Portland Cement.
2 barrels clean sharp sand.
6 barrels broken stone or hard-burnt brick or gravel will yield about 20 cubic feet.

Concrete of Natural Hydraulic Cement, such as Rosendale or "Union," may be made as follows:

1 barrel Hydraulic Cement.
2 barrels sharp sand.
4 barrels broken stone.

Foot Walks.

For bottom coat a concrete of
1 barrel Portland Cement.
2 barrels sand.
5 barrels broken stone.
For surface, 1 part Portland Cement.
1 part sand.

Coating of Iron Ships.

Equal parts of Portland Cement and sand laid one inch thick against the iron.

Artificial Stone and Blocks.

1 barrel Portland Cement.
6 barrels clean sharp sand.
Use as little water as possible, and ram well in metal moulds, if possible to be obtained.

Masonry.

For average masonry of rough stone, contractors estimate about one barrel of ordinary hydraulic cement and two barrels sand to the yard; or of Portland Cement about one barrel with two or three parts sand. For granite and cut-stone work the amount of cement is much less, depending on the character of the stone.

Brick Work.

For brick work of ordinary character a barrel of ordinary hydraulic cement, with two barrels of sand, is estimated to lay about one thousand bricks.

THE AMERICAN CEMENT CO.

220 S. Third Street, Philadelphia

OWNERS OF

The Egypt Portland Cement Works,
The Pennsylvania Portland Cement Works,
The Columbian Portland Cement Works, } *At Egypt, Lehigh Co., Pa.*
The Jordan Portland Cement Works, at Jordan, Onondaga Co., N. Y.

MANUFACTURERS OF

A high grade Portland Cement, equal to any of the imported brands in strength, fineness and durability. This cement is manufactured at the Company's Works, at Egypt, Pennsylvania.

A Portland Cement of the same quality as the above in the element of strength, fineness and durability, but slightly slower setting. This cement is made at the Company's Works, at Jordan, N. Y.

Made at the Jordan Works, and especially adapted to paving and artificial stone work, and equal to any imported Portland Cement for all purposes.

A first-class Portland Cement, especially fitted for use in heavy foundations, brickwork and concrete, and acquiring at long periods in sand mortars, a strength surpassing that of any Portland Cement in the market.

The highest grade of natural Cement in America. A mixture of Natural Hydraulic Cement Rock and Giant Portland Clinker—finely ground and of high tenstile strength as a sand carrier in mortar.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